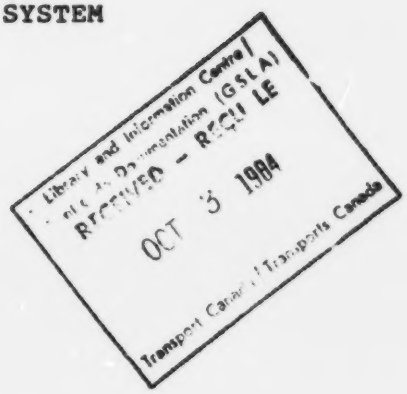
TP 5365E

FEASIBILITY AND DESIGN:

A VANCOUVER AREA INTEGRATED TRANSPORTATION INFORMATION SYSTEM



BY

D. SPAETH
MAYALI CONSULTANTS

G. W. BACHMAYER
CONSERVATION AND RENEWABLE ENERGY BRANCH
MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES
PROVINCE OF BRITISH COLUMBIA

APRIL 1984

REPORT DOCUMENTATION FORM

1. Transport Canada Report No.	2. TDC Project No.	3. Recipient's Catalogue No.
TP5365E	6105	

4. Title and Subtitle	5. Report Date
Feasibility and Design A Vancouver Area Integrated Transportation Information System	April 1984
	6. Performing Organization Report No.
7. Author(s)	8. Transport Canada File No.
D. Spaeth and G.W. Bachmayer	D1465-431
9. Performing Organization Name and Address B.C. Ministry of Energy, Mines and Petroleum Resources Conservation & Renewable Energy Branch 2011 - 1177 W. Hastings St. Vancouver, B.C. V6E 2L7	10. DSS File No.
	11. DSS or Transport Canada Contract No. 6105
12. Sponsoring Agency Name and Address Same as above and Transportation Development Centre 1000 Sherbrooke Street West Suite 2421 Montreal, Quebec H3A 2R3	13. Type of Report and Period Covered Final
	14. Sponsoring Agency Code
15. Supplementary Notes	16. TDC Project Officer L. Suen

17. Abstract

A study was conducted during the period November 1983 to April 1984 to examine the design and feasibility of an Integrated Transportation Information System (ITIS) for the Vancouver area. The study was undertaken in three stages and resulted in the development of an implementation plan for demonstrating an ITIS prototype during Expo 86.

First a concept plan was developed which described an automated information system and established performance objectives for such a system. In the second stage, a feasibility plan was developed which identified state-of-the-art computer and communication technologies following a review of similar applications elsewhere in North America and Europe. The ITIS concept was evaluated to assess its workability for a demonstration in Vancouver. The final stage developed a more detailed design for ITIS, as well as an implementation plan and in-field evaluation program.

18. Key Words	19. Distribution Statement
Transportation Information Expo 86, Vancouver	Available on request from the Transportation Development Centre.

20. Security Classification (of this report)	21. Security Classification (of this page)	22. No. of Pages	23. Price
Unclassified	Unclassified	84	-

TDC/CDT 79-005

FORMULE DE DOCUMENTATION POUR RAPPORT

1. N° du rapport Transports Canada	2. N° de l'étude — CDT	3. N° de catalogue du destinataire
TP5365E	6105	

4. Titre et sous-titre	5. Date du rapport
Feasibility and Design A Vancouver Area Integrated Transportation Information System	avril 1984
	6. N° du rapport de l'organisme exécutant

7. Auteur(s)	8. N° de dossier Transports Canada
D. Spaeth and G.W. Bachmayer	D1465-431

9. Nom et adresse de l'organisme exécutant	10. N° de dossier — ASC
B.C. Ministry of Energy, Mines and Petroleum Resources Conservation & Renewable Energy Branch 2011 - 1177 W. Hastings St. Vancouver, B.C. V6E 2L7	11. N° de contrat — ASC ou Transports Canada 6105

12. Nom et adresse de l'organisme parrain	13. Genre de rapport et période visée
Centre de développement des transports et ci-haut 1000 ouest rue Sherbrooke Suite 2421 Montreal, Quebec H3A 2R3	Rapport finale
	14. Code de l'organisme parrain

15. Remarques additionnelles	16. Agent de projet — CDT
	L. Suen

17. Résumé

Ce rapport présente les résultats d'une étude menée entre novembre 1983 et avril 1984 en vue de définir un système intégré d'information sur les transports dans la région de Vancouver, et d'en déterminer la faisabilité. Cette étude, à trois volets, a débouché sur la mise au point d'un plan pour la mise en service expérimental d'un prototype du système envisagé, à l'occasion d'Expo 86.

Le premier volet a consisté à définir le concept d'un système d'information automatisé et à consigner les performances attendues d'un tel système. Le deuxième volet s'est intéressé à la faisabilité du concept, recensant les techniques informatiques et de communication susceptibles d'être mises en oeuvre, à la lumière notamment d'applications similaires en Europe et ailleurs en Amérique du Nord. La possibilité de réaliser le système proposé à temps pour l'Expo 86 a aussi été évaluée. En dernière étape, les chercheurs ont poussé plus avant l'étude détaillée du système et ils ont élaboré un plan de mise en oeuvre ainsi qu'un programme d'évaluation pratique de celui-ci.

18. Mots-clés	19. Diffusion
Transports, information, Expo 86, Vancouver.	Disponible auprès du CDT.

20. Classification de sécurité (de ce rapport)	21. Classification de sécurité (de cette page)	22. Nombre de pages	23. Prix
Non-classifié	Non-classifiée	84	-

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the advice and assistance provided by the members of the Technical Review Group:

Peter Bell, B.C. Telephone Co.
Neil Clarke, Transport Canada
Gerry Mallett, EXPO 86
Ronald Rice, EXPO 86
David Rudberg, City of Vancouver
Lino Siracusa, Transport Canada
Barry Stevenson, B.C. Ministry of Universities, Science and Communication
Ling Suen, Transportation Development Centre
John Thompson, EXPO 86

In addition, the following individuals provided significant insights to the study:

Don Bellamy, B.C. Restaurant Association
Bill Bouchard, B.C. Ferries Corporation
James Boygo, B.C. Utilities Commission
Michael G. Clark, B.C. Ministry of Industry and Small Business

Frank Eberdt, Rogers Cable T.V. Ltd.
Phil Gardner, B.C. Ministry of Universities, Science and Communication

Robert Glover, B.C. Transit
Roger Hart, Knowledge Network
Don Kasienchuck, B.C. Ministry of Transportation and Highways

William Leithead, Canada Harbour Place Corporation
D.C. McAree, Transport Canada
Fred Oakley, Greater Vancouver Visitors and Convention Bureau

John Oram, Denman Inn
Mike Patterson, University of B.C.
John Quigley, Government of Canada, Department of Communications

Clive Rock, B.C. Transit
Vic Sharman, Metro Transit Operating Company

TABLE OF CONTENTS

Outline	Page
1. INTRODUCTION	
1.1 The ITIS Concept	1
1.2 Purpose and Methodology	1
1.2.1 Purpose	
1.2.2 Methodology	
2. WHAT IS THE CONCEPT?	
2.1 Information System Features	3
2.1.1 Automated Information	
2.1.2 Most Transportation on Same Menu	
2.1.3 Current and Accurate Information	
2.1.4 Several Ways to Contact TIS	
2.1.5 Delegated Data Base Maintenance	
2.1.6 Special Use by the Disabled	
2.2 Why An Information System?	5
2.2.1 More Effective Use of Transportation	
2.2.2 Demonstration During EXPO '86 World's Fair	
2.2.3 Development of a High-Technology Product	
3. REVIEW OF OTHER TIS	
3.1 Overview	8

Page

3.2 Telephone-Based Systems 8

3.2.1 Telerider
3.2.2 Hamburg Automated Information System (AFI)
3.2.3 Japanese Building Society

3.3 Display Terminals 9

3.3.1 Teleguide
3.3.2 Other Display Terminal Systems

3.4 Computer Service Networks 11

3.4.1 Transportation Information
3.4.2 Networking in Vancouver Area
3.4.3 T.V.

4. ITIS SYSTEMS EVALUATION

4.1 Overview 15

4.1.1 Criteria
4.2.2 Conclusions

4.2 Demand for ITIS 16

4.2.1 Vancouver Area Transportation Suppliers
4.2.2 B.C. Hospitality Industry
4.2.3 EXPO 86 Market Potential

Page

4.3 Workable ITIS Configuration 21

4.3.1 What Information?
4.3.2 Terminal Devices
4.3.3 Basic System Architecture
4.3.4 Data Base

4.4 Financial Feasibility 33

4.4.1 ITIS System Costs
4.4.2 Local Revenue Potential
4.4.3 The Balance Sheet
4.4.4 Cost Comparison of Alternatives

5. DESIGN OF A DEMONSTRATION

5.1 Interface Architecture 38

5.1.1 Telephone (Voice) Inquiries
5.1.2 Asynchronous Computer Inquiries
5.1.3 Synchronous Communication

5.2 ITIS Software/Data Base 40

5.2.1 General Programming Approach
5.2.2 Vocabulary
5.2.3 Relating to Other Data Base and Systems

5.3 Hardware Requirements 41

5.4 Telecommunications Network 42

Page

6. PUTTING ITIS IN PLACE

6.1 Work to be Done 43

6.1.1 Prototype
6.1.2 System Development
6.1.3 ITIS Demonstration

6.2 Schedule 45

6.3 Organization 45

6.3.1 Objectives
6.3.2 Approach

6.4 Costs 47

7. A MONITORING PROGRAM

7.1 Purpose 48

7.1.1 Other Potential Benefits
7.1.2 Methodology

7.2 Work Program and Schedule 50

1. INTRODUCTION

1.1 The ITIS Concept

Imagine that you could get up-to-date information about any kind of transportation in the Vancouver area. As a resident, you could find out about traffic conditions on the way to work, when the next bus would arrive at your stop, where to find parking at special events and how to take a trip out-of-town by airplane, bus or train. If you are a visitor to Vancouver, you need not feel out of place - information about local transportation will be at your finger tips. You also can get information about where to stay and what to do (restaurants, entertainment, events and tourist attractions).

The information system that makes this possible could be available over the telephone, on cable T.V., by using your home computer or by using special display terminals located in hotels, public buildings and transportation centres. The heart of this Integrated Transportation Information System (ITIS) will be a computer that stores all the information, handles the inquiries and gives an answer, either as a "picture" or a computer-compiled voice message.

The idea for a Transportation Information System was conceived by Mayali Consultants and developed jointly with the B.C. Ministry of Energy, Mines and Petroleum Resources, who then applied to and received funding from the Transportation Development Centre for the project.

The purpose of this report is to examine the design and feasibility of such a system for the Vancouver area.

1.2 Purpose and Methodology

1.2.1 Purpose

The study starts with the idea that demonstrating an ITIS system in the Vancouver area could be beneficial in three ways:

(1) To be a first test of the ongoing value of automated transportation for the third largest metropolis in Canada.

(2) To develop a high-technology product for sale to other large cities throughout the World --- a product that "packages" Canadian expertise in transportation, video communications, computer voice synthesis and certain area of computer software.

(3) To provide a low cost and high profile way for both visitors and Vancouver residents to use regional, B.C. and intercity transportation during EXPO 86.

1.2.2 Methodology

After developing the ITIS concept, the study went through several steps to evaluate it and to design a specific demonstration project in the Vancouver area during 1984-6. These steps were:

(Section 2): Developing the ITIS concept and considering its potential,

(Section 3): Reviewing other automated transportation and hospitality information systems, as well as aspects of the Vancouver area telecommunications network that could effect an ITIS demonstration,

(Section 4): Evaluating the demand for an ITIS, its practicality and profitability in the Vancouver area,

(Section 5): Describing an ITIS demonstration,

(Section 6): Outlining the work, organization, timing and resources needed to put an ITIS demonstration in place, and

(Section 7): Discussing the approach, timing and resources needed for a monitoring plan to see if the ITIS demonstration achieved its objectives.

The study is intended as an overview. Accordingly, it is based on a literature review, discussions with transportation and information system suppliers and a general survey of data in the Vancouver area.

2. WHAT IS THE CONCEPT?

2.1 Information System Features

2.1.1 Automated Information

Automated transportation information systems (TIS) are beginning to be used by a number of North American and European cities to provide information to the public. Typically, these systems store-up-to-date information in a computer about schedules, routes, fares and other service characteristics. Depending on the TIS, inquiries may be made by telephone, or by entering a request from a special display terminal or home computer. Automated telephone information systems answer calls with a computer generated voice message, while special display terminals illustrate information graphically or give out printed copy.

The advantages of these systems include:

- Using the same information for two different purposes--information that is needed by operators of transportation services can also be made available to the public in an easily understood form.

- Reducing operating costs for larger telephone transportation information systems, compared to those that are telephone operator assisted.

- Responding more reliably and quickly to inquiries and giving more accurate information than can be provided by operator answered telephone lines, signs and printed materials alone.

2.1.2 Most Transportation on Same Menu

TIS systems currently in use usually provide information about only one kind of transportation: public transit, airlines, trains, or traffic conditions, but not all together.

The concept of an integrated TIS for the Vancouver area (ITIS) is the new idea of combining several kinds of transportation on one menu (a menu is a list of choices from which selections can be made by the user).

The major advantages are:

- The convenience of only having to contact one system.

- o Giving the user the ability to make choices amongst different ways of making a trip.

- o Combining transportation information with destination information regarding accommodation, restaurants, entertainment, recreation, etc.

- o Making multiple use of common system software, including: call handling, road and transit networks, route selection, map generation and large parts of computer voice vocabulary.

- o The cost-effectiveness of suporting and advertising only one system.

- o The revenue potential of several transportation suppliers subscribing to the same system.

2.1.3 Current And Accurate Information

An ITIS for the Vancouver area would use the same up-to-date information that is generated and used by transportation suppliers to operate and manage their systems. As more operations information is handled by computer, the ITIS data base could be updated by direct computer-to-computer file transfer.

Experience with other TIS systems shows that the public will use them only if the information they provide is current and accurate. For ITIS, this will mean a combination of "real-time", up-to-date schedule and accurate directory information. Better quality information can be provided less expensively than existing systems in Vancouver area by relying on operations information.

2.1.4 Several Ways To Contact ITIS

Other TIS systems typically have only one of the following means of contacting them: telephone, special display terminal, home computer or cable T.V. An ITIS for the Vancouver area could be contacted in several ways. In addition to making ITIS more accessible, this has the advantage of combining the assets and overcoming the limitations of each method.

Figure 1

INTEGRATED TRANSPORTATION INFORMATION SYSTEM

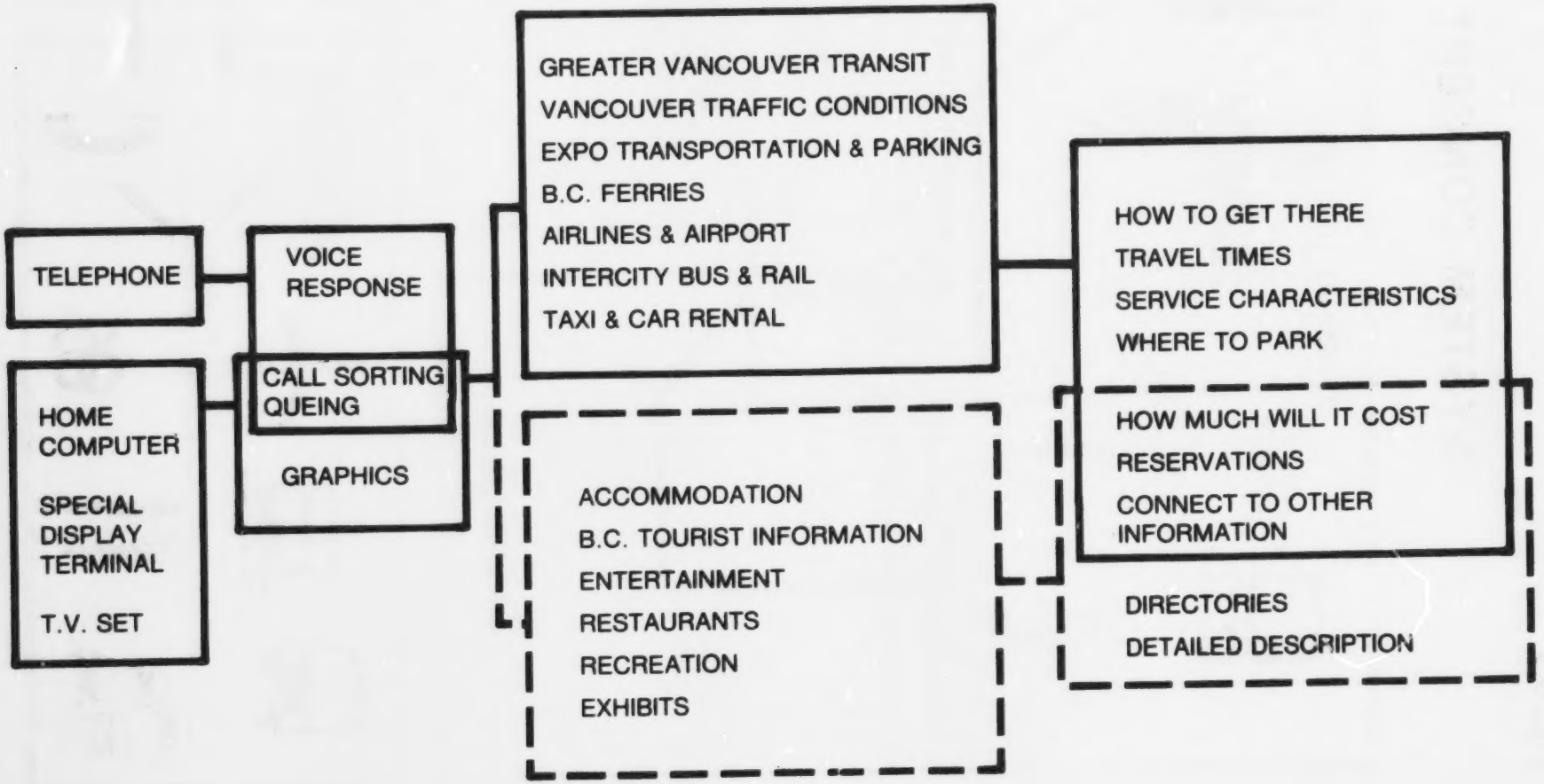
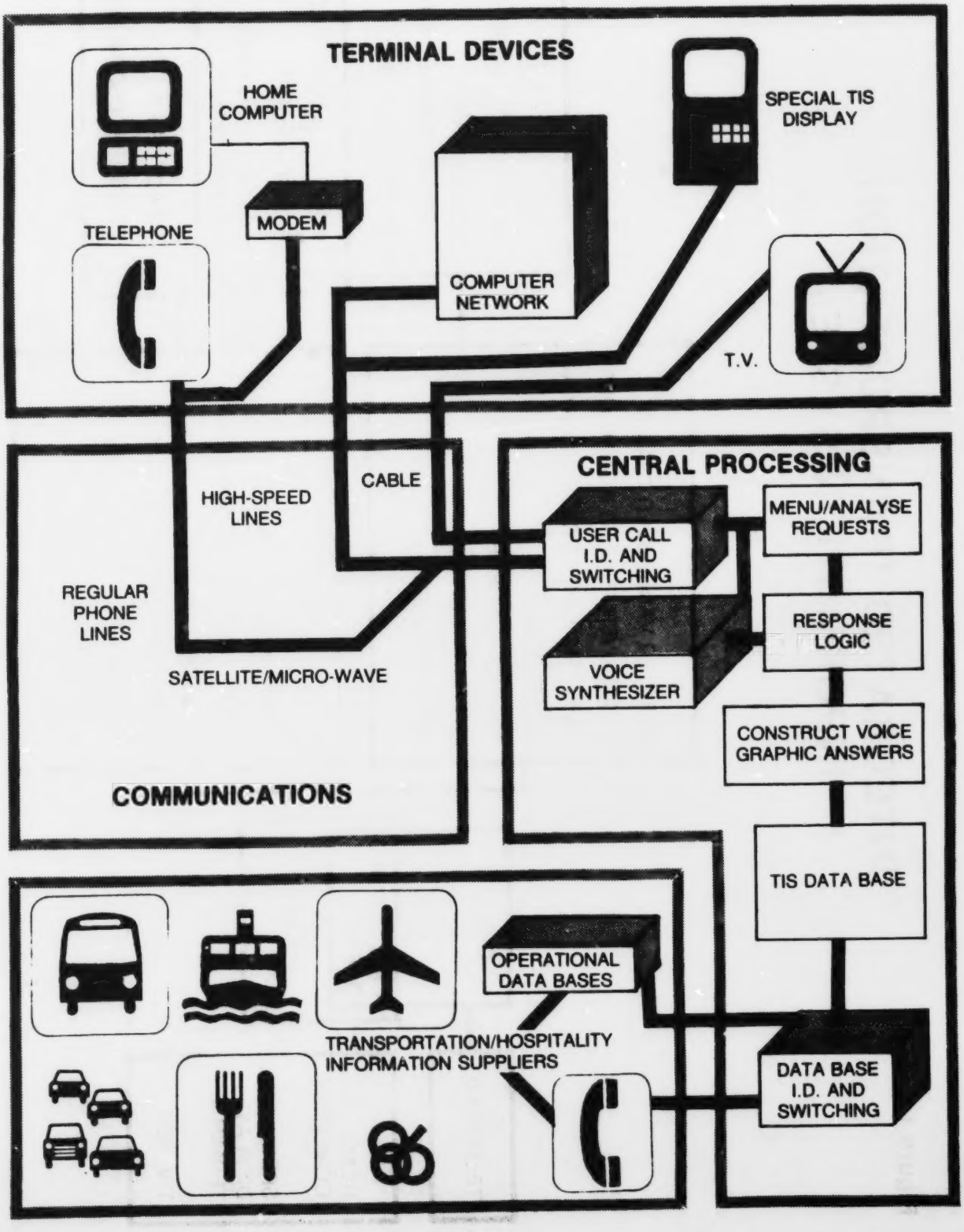


Figure 2

SYSTEM CONCEPT



For example, while the amount of information that can be communicated by voice over the telephone is fairly limited, telephones reach by far the largest market of potential ITIS users. Special Display Terminals can communicate a wide variety of information, but would have a much more limited distribution because of cost. Cable T.V. and home computers fall in between these in their availability and capacity to communicate transportation information.

2.1.5 Delegated Data Base Maintenance

Maintaining a current and accurate data base has proven to be one of the largest ongoing costs of operating a TIS. This is particularly the case when the TIS itself assumes that responsibility. Instead, the concept for Vancouver ITIS would test the idea of delegating a significant part of data base maintenance to transportation suppliers (and possibly the hospitality industry) subscribing to the system.

2.1.6 Special Use by the Disabled

People who are hearing and/or sight impaired may not be able to use radio, T.V. or the telecommunications system to get transportation information. These and other disabled persons may also have special transportation needs. ITIS can use several media to provide information about either regular or special transportation including: visual display for the hearing impaired and voice message or brail for the sight impaired. Although this information could be available from special terminals, perhaps a more significant opportunity exists to provide it to the disabled interactively using the telephone, T.V. or home computers.

2.2. Why An Information System

2.2.1 More Effective Use of Transportation

A significant benefit of ITIS may be that by providing the public with better information about their transportation system, they could use it more efficiently. If this is so, then there is an opportunity to reduce both private sector and government costs for transportation in several ways:

- Delay major new transportation projects (to the extent that ITIS results in more intelligent use of in-place transportation capacity).

- o Reduce private congestion related costs including the significant dollar costs of delay, maintenance, accidents, and pollution.

- o Reduce the consumption of non-renewable energy by more efficient use of transportation.

One objective of a ITIS demonstration for the Vancouver area will be to test these potential benefits, by conducting a "before and after" evaluation program (see Section 7).

2.2.2 Demonstration During EXPO 86 World's Fair

EXPO 86 provides a unique opportunity to demonstrate the ITIS concept for two main reasons:

1) There will be heavy use of transportation throughout Southern B.C. during the Exhibition. ITIS could be a highly visible but relatively low cost commitment to make the most of existing transportation while EXPO is open. This is particularly attractive because transportation is the theme of EXPO.

2) The Exhibition will provide worldwide exposure for the suppliers of hardware and software to a potentially exciting high-technology product.

However, ITIS is intended to continue providing transportation information in the Vancouver area after EXPO 86. The ITIS concept could be applied to other urban areas in North America and Europe, and an ITIS demonstration could be viewed as a first step toward Canadian development of a high-technology product for world markets, whether or not the demonstration occurs during EXPO 86.

(ITIS will not replace the need for other media to provide general transportation information for EXPO. For example, dedicated Cable T.V. channel(s) and perhaps a special radio station could be set up to provide information about congestion, parking conditions, special transportation services, accidents, etc.. Bulletins on regular channels and stations could provide similar information. The differences would be that broadcasts of passive information must necessarily be kept general, and that the user must wait for the information, not always knowing when it will be available.)

2.2.3 Development of High Technology Product

The possibility of developing ITIS as a high-technology product is attractive for several reasons:

- Firstly, Canada already leads in the development and marketing of some of the main components of the system, for example, video graphics and automated transit information systems. ITIS represents the next logical step, that of putting these innovative products together into a complementary package.

- Secondly, ITIS is a significant application for areas of the high-technology industry that are being encouraged to grow in British Columbia.

- Thirdly, because it is a fairly complex package of both software and hardware, ITIS might not be as easily duplicated by other countries as individual hardware or software products.

- Finally, the major cost of ITIS is likely to be in the system software, most of which is transferable to other urban areas. This could make ITIS financially attractive compared to home grown products in other urban areas.

3.REVIEW OF OTHER TIS

3.1 Overview

Automated information systems operating locally and in other cities in North America and Europe were reviewed as a starting point to developing and evaluating an ITIS for the Vancouver area. As indicated earlier, existing TIS systems are typically "single purpose" and accessible in only one way. However, as this selected review suggests, a number of already workable features from these systems could be incorporated in a ITIS.

3.2 Telephone-based Systems

3.2.1 Telerider

Telerider(TM) is an automated telephone system supplied by Teleride/SAGE that provides one important kind of information about public transit. Upon dialing the TIS prefix and then the bus route and stop number, callers hear a computer-compiled voice message telling them when the next bus will arrive at their stop.

Telerider systems have now been installed by over ten transit operators in Canada and the U.S. Only Mississauga provides "real-time" information, the other Telerider systems describe current schedule information for the appropriate time of day. This information is obtained from the master scheduling program, supervisor updates and special adjustments (for parades, detours, etc.). According to Teleride/SAGE, some of the other existing Telerider systems may be upgraded to provide real-time information.

Some Telerider systems are capable of handling call rates of over 5,800 calls/hour, and one major advantage of the system is that calls are handled virtually without delay. The cost to install Telerider ranges very roughly from $500,000 to over one million (1984 dollars). Increases in ridership and revenues generated by including paid advertising in the voice message have been shown to offset costs in several installations.

Telerider uses DEC and IBM computer equipment. The system reserves a large block of telephone numbers, one for each bus route and stop. Telerider is a "one-message" system that can be accessed by either dial (pulse) or Touch Tone telephones. The system is not interactive.

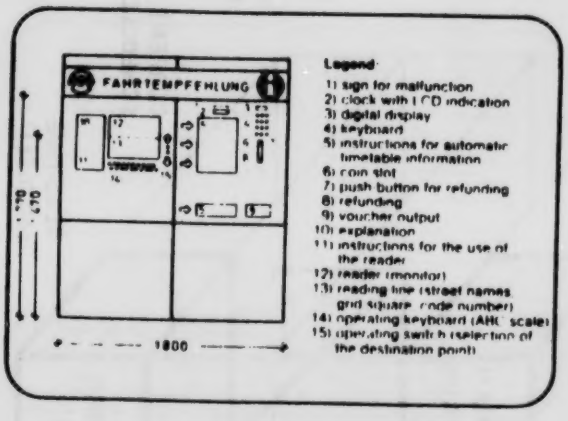
Figure 3

TIS TYPOLOGY
(AND SELECTED EXAMPLES

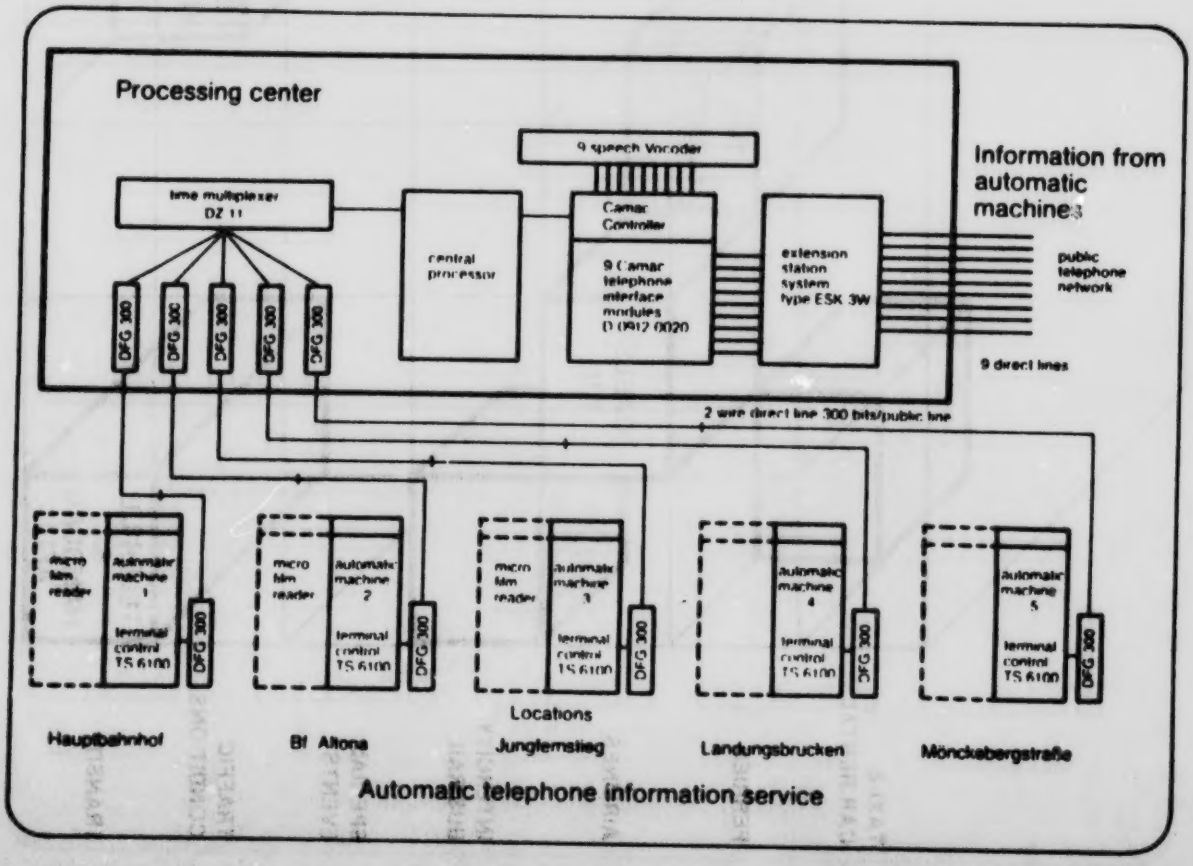
Figure 4

HAMBURG AUTOMATED INFORMATION SYSTEM

AUTOMATIC INFORMATION MACHINES



MAIN COMPONENTS OF THE HAMBURG AUTOMATED TELEPHONE INFORMATION SYSTEM



3.2.2 Hamburg Automatic Information System (AFI)

An automated telephone (voice) information system has been operated by the Hamburger Verkehrsverbund (transit authority) on a demonstration basis since 1979.

The AFI system is interactive. Upon reaching the system and hearing a computer-compiled introductory message, callers overdial code numbers for their origin and destination locations, as well as for the type of information requested. AFI software then "talks" to the caller, by receiving overdialed codes; selecting the appropriate information on schedules, routing, transfers, wait and trip times from data base; and by compiling the correct response from a digital voice vocabulary.

AFI can be accessed by both Touch Tone(TM) and dial telephones, although the latter require special technical provisions by the telephone company. The demonstration uses a DEC PDP 115600CD computer. The demonstration costs roughly 2.5 million DM (about one million 1984 U.S. dollars), and capital costs to expand AFI to a region-wide service are estimated to be an equivalent amount. The full system is estimated to cost .9 to 1.0 million DM (excluding amortization of capital). When expanded, AFI would be capable of handling up to 1000 calls per hour, using a PDP 11/44 computer.

3.2.3 Japanese Builders Society

Although not a transportation information system, the automated telephone system that is available to members of the Society is an interesting example. Upon calling a number, members can over-dial characteristics of a building project and then receive quantity take-offs and prices for the construction.

3.3 Display Terminals

3.3.1 Teleguide

The Teleguide system provides hospitality and some transportation information through a network of approximately 500 video display terminals located in major hotels, transportation terminals and public buildings throughout metropolitan Toronto.

Roughly 200 of these terminals are heavy-duty units appropriate for public use and abuse. The remaining Teleguide terminals are installed in the offices of transportation suppliers, government agencies, the hospitality industry and others. Video terminals are connected to a host computer by a dedicated network of phone lines. The system is interactive. Users enter selections from a menu using the terminal keyboard and view videotex pictures sent to the terminal by the host in response. Teleguide uses Telidon protocol to generate and transmit video frames. The host computer also performs system administration, routine terminal diagnostics and centralizes data base updating, as well as monitoring the type and frequency of information that is requested.

Teleguide is supplied by the Infomart Corporation, and is a commercial venture. Infomart generates revenue by charging subscribers a fee for each page that is displayed on the Teleguide system.

3.3.2 Other Display Terminal Systems

B.C. Telephone conducted a Telidon(TM) demonstration in the Vancouver area during 1981-83. During the demonstration, terminals were installed in selected public buildings, the Vancouver International Airport and shopping centres. Terminals were connected to a host computer, which maintained a centralized data base and transmitted video frames over telephone lines in response to menu choices entered on the terminal keyboard. The demonstration is not operating at the present time.

Elsewhere in North America, Manitoba has "Grass Roots", a videotex agricultural information system also supplied by Infomart. A Telidon protocol system is providing hospitality information to tourists in Louisiana. Suppliers plan to expand the system to several states in the South. The State of Hawaii is studying a statewide TIS that would include both a video terminal network and automated telephone (voice) access.

Europe provides examples of transportation information display terminals that dispense printed output. In addition to automated telephone (voice) response, the Hamburg AFI system described in Section 3.2.2 also has automatic information machines in transit terminals that dispense a card with information on the transit routing, departure time, transfers and travel time for a requested destination. The German National Railway operates a similar automatic information machine network, which prints out very sophisticated trip plans upon request.

The technology for display terminal systems is evolving rapidly. For example, state-of-the-art work is being done in Canada on touch-screens for entering requests, simplified menu graphics and "semi-smart" terminals, which can store and generate video frames in response to short commands from the host computer (eliminating "on-request" transmission of complex graphics).

Canadian companies and the federal government took the lead a few years ago when they developed Telidon and several proven in-service video systems based on it. Ironically, there is some evidence that these systems are generating much more interest in the U.S. and Europe than they are within Canada. There are indications of keen competition in the world market during the next few years for this type of system.

3.4 Computer Service Networks

3.4.1 Transportation Information

Since computer service networks are commercially viable on the basis of information provided at marginal costs to a very large market, they are not inherently suited to incorporating localized transportation information. However, these networks can and do provide some inter-city transportation information. An interesting example is The Source(TM), a general subscription service that offers air travel planning by tapping into the recently computerized U.S. carrier's schedule catalogue.

Computer service networks also develop and maintain the capability of establishing communications with a wide variety of home computers, mini-computers and mainframes.

3.4.2 Networking in Vancouver Area

Development of a Vancouver area ITIS will require a fairly sophisticated communications network, if it is directly connected to computers with transportation data bases, special display terminals and possibly to home computers. Perhaps more importantly ITIS will have to incorporate the software that enables a variety of computers to "talk to each other" and to ITIS. Although they are not strictly transportation related, two general computer networking resources were reviewed for possible use by a Vancouver ITIS: UBCnet and the Knowledge Network.

UBCnet provides access to the extensive computing resources of the University and connects it via Knowledge Network, as well as other networks, to academic, public sector and commercial computers. At the present time, a significant proportion of the Vancouver area transportation data base and analytical capability resides on the UBC system or other systems accessed through UBCnet, including: modelling, network descriptions and travel data. From this standpoint alone, it makes sense to consider ITIS communication with UBCnet.

Fairly recently, UBC developed the "Help" Program to enable a variety of micro-computers and terminals to establish two-way communication with the system. Software provided to users at no charge (with the exchange of a floppy-disk) gives them access to "Help" by automatically providing a special "Help Only" password and account. While in "Help", users can get a wide variety of information about UBCnet. Users having an individual password and account can then go on to establish communication with other parts of the system, whereas those without valid accounts are prevented from doing so.

UBCnet is also interlinked with other university systems and commercial services through local networks and Datapac.

Figure 5

DISPLAY TERMINALS

TYPE	CHARACTERISTICS	AVAILABLITY
VIDEO	KIOSK STYLE COMPLEX COLOUR IMAGES SIMPLE NUMERIC KEYBOARD	MANUFACTURED
	TOUCH-SCREEN SOME ON-BOARD PROCESSING	CUSTOM ASSEMBLY FROM MANUFACTURED PARTS
CHARACTER GRAPHICS	KIOSK OR WALL MOUNTED COLOUR LISTING OR SIMPLE IMAGES KEYBOARD OR TOUCH-SCREEN MAY HAVE ON-BOARD PROCESSING	MANUFACTURED
HARD COPY	KIOSK OR WALL MOUNTED SIMPLE NUMERIC KEYBOARD INFORMATION DISPENSED ON PRINTED CARD	MANUFACTURED
MULTI-MEDIA	KIOSK OR WALL MOUNTED KEYBOARD KEYBOARD (RAISED SYMBOLS AND BRAILLE) VIDEO SCREEN PRINTED COPY SYNTHESIZED VOICE MESSAGES	ENGINEERING & CUSTOM ASSEMBLY (SOME PARTS MANUFACTURED)

Figure 6

TERMINALS SUPPORTED BY UBCNET "HELP" MENU

Machine	Documentation	
APPLE II's*	MCP:APPLE.DOC.	
(with a Z80-card)*	MCP:CP/M.DOC.	MCP:I8080.DOC
(with an 8088-card)	MCP:WINDOW.DOC	
Altos-8000	MCP:CP/M.DOC	MCP:I8080.DOC
Alspa	MCP:CP/M.DOC	MCP:I8080.DOC
Cromemco Z2	MCP:CP/M.DOC	MCP:I8080.DOC
Heath Zenith H8 or H89s	MCP:CP/M.DOC	MCP:I8080.DOC
Kaypro II*	MCP:CP/M.DOC	MCP:I8080.DOC
Morrow Designs Micro Decision	MCP:CP/M.DOC	MCP:I8080.DOC
NEC PC8000	MCP:CP/M.DOC	MCP:I8080.DOC
Ontel Amigo	MCP:CP/M.DOC	MCP:I8080.DOC
Osborne-1*	MCP:CP/M.DOC	MCP:I8080.DOC
Sanyo MBC-1000	MCP:CP/M.DOC	MCP:I8080.DOC
Superbrain	MCP:CP/M.DOC	MCP:I8080.DOC
TRS-80 MOD II (CP/M)	MCP:CP/M.DOC	MCP:I8080.DOC
Vector Graphic VIP	MCP:CP/M.DOC	MCP:I8080.DOC
IBM PC*	MCP:WINDOW.DOC	
Victor 9000*	MCP:WINDOW.DOC	
KDS 7860*	MCP:WINDOW.DOC	
Wang PC*	MCP:WINDOW.DOC	
RT-11*	MCP:RT11.DOC	MCP:PDP11.DOC
RSX11M//IAS	MCP:RSX11M.DOC	MCP:PDPD11.DOC
RSTS	MCP:RSTS.DOC	MCP:PDPD11.DOC

Knowledge Network includes participation in a broadband cable system linking UBC, the teaching hospitals, law courts, Simon Fraser University and locations generally in Downtown Vancouver and along Kingsway as far as the Burnaby Metrotown area. A number of channels are available to Knowledge Network, for anticipated use for a number of purposes, including: course sharing, team teaching, conferencing, field demonstrations, community health care subsystem, trial observation and Downtown credit courses.

Knowledge Network is of interest to an ITIS, if only because the institutions it connects are major transportation users and the Network could "wholesale" information supplied by ITIS to terminal locations in participating institutions. The Network could also provide an important communication link between transportation related research and development activity in some of these institutions and ITIS.

3.4.3 T.V.

CABLE T.V: Several kinds of transportation information are already available on Cable T.V. as passive displays on dedicated channels. These include: airlines arrivals/departures, B.C. Ferry information and travel related information, such as weather and civic events programs. However, the viewer has a limited selection of transportation information, and cannot "ask questions" of the T.V. set.

There is considerable interest in using Cable T.V. as an interactive two-way communications medium between home and broadcaster for a wide variety of information. This has lead to development work on technologies that may be useful to ITIS in the next few years:

- One product in the development and pre-marketing stage is a "smart frame-grabber". Essentially, the cable company continuously sends large numbers of video pictures on one or more 6 Mega Hz channels. Frame-grabbing equipment attached to any home T.V. that is on cable can selectively choose from these pictures to make up a display that is not truly interactive, but seems to be because images appear on the user's T.V. screen on command.

Smart frame-grabbers marketed in the next 2-3 years could include either a married pair of home computer and frame grabber supplied by the NABU Corporation, or a universal frame-grabber that is being developed by Videotron Corporation to connect to several popular home computer brands.

- o A second approach involves developing a terminal device connected to home T.V. that can send an addressed "information request" to a host computer in the cable T.V. supplier's offices. The computer responds by sending out a discreet "package" of video information to that address. At any point in time, the cable will carry large numbers of these addressed packages, and at the home end the terminal device must be able to pick out and display its own package from amongst those going to other addresses. This approach is interactive, and could involve either digital signals or frequency based switching.

Theoretically, ITIS could use either of these cable T.V. communication technologies, if they become available, to transmit selective transportation information.

BROADCAST T.V.: A decoding device also can be used to access information transmitted along with an ordinary television signal during the blanking interval i.e. the time interval between regular pictures or frames sent in the TV signal.

A normal TV signal consists of about 30 separate but complete pictures or frames sent every second. Because they occur so rapidly the human eye perceives them as moving pictures. The blanking interval occurs between these separate pictures and can be used to transmit a variety of information.

In the U.S., Field Electronic Publishing plans to provide a nationwide teletext programming service by inserting the information into the vertical blanking interval of the Atlanta superstation WTBS-TV which is transmitted on Satcom 3. Teletext decoders are not interactive but may be a low cost alternative to providing the more expensive interactive videotex information system.

4. ITIS SYSTEMS EVALUATION

4.1 Overview

To be effective, an TIS must communicate information about the overall transportation system, and be available to a large part of the general public. Essentially, this means an ITIS that is automated, that contains current and accurate information about most kinds of transportation and that can be contacted in a variety of ways. THERE ARE NOT ANY TIS SYSTEMS AVAILABLE NOW THAT HAVE ALL OF THESE FEATURES. THAT IS WHAT MAKES THE CONCEPT OF DEVELOPING SUCH A SYSTEM FOR THE VANCOUVER AREA AND OTHER CITIES SUCH AN EXCITING ONE.

4.1.1 Criteria

The evaluation that is described in this section focuses on whether there is a workable "package" of technology that can meet an identified demand. The evaluation also assesses the financial feasibility of an ITIS for the Vancouver area, essentially as a business proposition.

- Demand (Section 4.2): What information is provided by existing systems in Vancouver area? How much of this and additional demand could be provided by ITIS?

- Workable ITIS Configuration (Section 4.3): What information can ITIS practically provide? What is a workable configuration of technology that will be available by 1986? Are B.C. and Canadian suppliers available?

- Financial Feasibility (Section 4.4): What will ITIS cost? What is the potential revenue? How do costs and revenue compare with existing Vancouver area information systems, both overall and on a per call basis? Is ITIS feasible as a business venture?

- Product Development (Section 4.5): What are other applications and spin-offs for ITIS?

The evaluation in Section 4 focuses on ITIS costs and benefits compared to other ways of providing transportation information. The broader implications of ITIS, such as saving transportation costs, time and energy are discussed in Section 7. Although ITIS is a "transportation" information system, during the study, several synergisms related to hospitality information became apparent. Accordingly, an interconnected system combining the two is evaluated as a possibility.

4.1.2 Conclusions

Figure 7 summarizes the evaluation. The conclusions are:

- ITIS could provide transportation and hospitality information to the Vancouver area less expensively than at present.
- ITIS could be practical depending on the design. It could supply "one-stop-shopping" for everyday and special transportation information needs.
- A Vancouver area ITIS could turn a profit after 5-9 years, if the cost of delivering information over the telecommunications network is kept to a minimum or shared with other information systems.

4.2 Demand for ITIS

To be effective ITIS must be available to a large share of Vancouver area residents, and visitors as well. ITIS should be designed to handle automatically a significant part of the inquiries that are currently answered by existing information services.

Figure 8 summarizes the categories of potential demand for ITIS. Overall, it is estimated that an ITIS demonstration could receive roughly 30,000 inquiries on an average day, if it were in place during EXPO 86. About 25-35% of the potential inquiries would come to ITIS instead of to existing information services. A similar amount would be ongoing demand for new information, and the remaining 30-50% would be EXPO 86 related. Specific categories of demand are discussed below.

Figure 7

AUTOMATIC TIS CHARACTERISTICS

SYSTEMS	TYPE	ACCESS	POPULATION AVAILABLE	INFORMATION MODE	INFORMATION CATEGORY	LANGUAGE	DEVELOPMENT STATUS	DEMONSTRATION COST
TELERIDER	One Message	Touch-Tone Dial Phone	100%	Public Transit	Schedule Real-Time	Synth. Voice	Operating in 10 Cities	$400-700,000
HAMBURG AFI	Interactive	Touch-Tone Dial Phone Display Term.	100%	Public Transit	Route Schedule Fares Trip Time	Synth. Voice Screen List Printed Card	Demonstration in Hamburg	$800-1,200,000
HAWAII STATE	Interactive	Telephone Display Term. Cable T.V. Computer	100%	General Transportation	Routes Schedule Fares Trip Time Traffic Directory	Synth. Voice Video Display	Initial Study	N.A.
TELEGUIDE	Interactive	Display Term. Network Host Computer	2-10%	Hospitality	Directory Activity Map Locat.	Video Display	Operating in Metro Toronto	$3,000-4,000,000
VANCOUVER TELIDON	Interactive	Display Term Network Host Computer	N.A.	Hospitality General Information	Directory Activity Location	Video Display Library	Completed	N.A.
LOUISIANA STATE	Interactive	Display Term. Network Host Computer	1-2%	Hospitality	Directory Activity Location	Video Display	Start-up Operation	Similar to Teleguide
TELERIDE VIDEO	Interactive	Display Term. Free Standing	1-2%	Public Transit	Routes Schedule Fares Trip Time Advertis.	Touch Screen Video Display	Proto-type Demonstrated	Units Cost $8,000
VANCOUVER CABLE T.V.	Interactive	Addressed Converter	8%	General Information	Airlines Other	T.V. Screen	Initial Manufact. of NABU Unit	Units Cost app. $1,000
COMPUTER SERVICE	Interactive	Home Computer wt. Modem	2-4%	General Information	Airlines Other	CRT/Printer	Operational in North America	N.A.

Figure 8

DESCRIPTION OF TRANSPORTATION INFORMATION DEMAND

TRANSPORTATION	Suppliers	EXISTING INFORMATION SYSTEMS Characteristics	Inquiry Rates PER DAY	PEAK HR.	Information Provided	ROLE FOR ITIS	POTENTIAL ITIS DEMAND
VANCOUVER AREA							
Vancouver Regional Transit System	METRO TRANSIT OPERATING CO.	Telephone Operator (manual)	3-5000	1500	1) Routes & Transfers 2) Schedules by Route 3) Fares & Gen. Info.	Automate 1-3	3-4,000
Vancouver Traffic Conditions	RADIO STATIONS	Broadcast from Aerial Survey	—	—	1) Traffic Conditions 2) Closures/Detours	Automate 1-2	
	ENGINEERING & HIGHWAYS DEPTS.	Telephone Someone in Dept.	1-200	N.A.	3) Specific Inquiries 4) Complaints	Provide Route Information	2-3,000
Downtown Parking	INDIVIDUAL LOTS	Telephone Lot Attendant	1-200	N.A.	1) Parking Availability 2) Reservations	Automate 1 Connect Reserv.	1-2,000
Taxis	INDIVIDUAL TAXI COMPANIES	Telephone Computer Assisted Dispatch	10-15000	2000	1) Call Taxi 2) Book Reservation	Connect Dispatch of Chosen Co	2-300
Car Rentals	INDIVIDUAL RENTAL COMPANIES	Telephone Sales Agent	3-400	N.A.	1) Gen. Information 3) Reservations	Automate 1	1-200
B.C. AND BEYOND							
B.C. Ferries	CABLE T.V.	Screen Listing	—		1) Sailings		
	B.C. FERRIES	Phone Message &	100-1200		2) Gen. Information	Automate 1-3	1,500- -2,000
	CORPORATION	Computer Assisted Operators	14-2800	500	3) Waiting Time/Space 4) Reservations 5) Customer Service 6) Complaints	Trip Planning	
Intercity Rail	VIA RAIL & B.C. RAIL	Phone Message & Ticket Agents	1-200	N.A.	1) Routes & Schedules 2) Arrivals/Departures 3) Ticket Information 4) Reservations 5) Customer Service 6) Complaints	Automate 1-3 Connect to Rail Info Lines	100-200
Intercity Bus	GREYHOUND PCL GROUP	Phone Message & Ticket Agents	3-400	N.A.	1) Routes & Schedules 2) Arrivals/Departures 3) Ticket & Gen. Info. 4) Customer Service 5) Complaints	Automate 1-3	3-400
Airlines	CABLE T.V.	Screen Listing	—	—	1) Arrivals/Departures		
	COMPUTER SERV.	Screen Listing	N.A.	N.A.	2) Trip Planning 3) Ticket Information	Automate 1-2	5-600
	INDIVIDUAL AIRLINES	Telephone Computer Assisted Ticket Agents VDT in Airport	N.A.	N.A.	4) Reservations 5) Customer Service 6) Complaints		

Figure 9

POTENTIAL EXPO TRIPS AND TRANSPORTATION INQUIRIES

AREA	EXPO TRIP ZONES	METRO TRANSIT	CHARTER BUS	SHUTTLE BUS	PARK N' RIDE	TAXI	AUTO DRIVER	TOTAL
DOWNTOWN VANCOUVER	25	1,300	4,700	1,500	—	2,400	200	10,100
REST OF VANCOUVER	17-24	6,700	1,800	9,400	—	1,400	4,100	23,400
ELSEWHERE IN REGION	1-16	6,200	4,400	1,400	8,400	—	13,400	33,800
OUT OF TOWN	26-30	—	11,000	—	—	—	2,600	13,600
TOTAL TRIPS		**14,200**	**21,900**	**12,300**	**8,400**	**3,800**	**20,800**	**80,900**
EST. DAILY INQUIRIES		570	2,850	620	2,100	1,520	2,450	10,100
INQUIRY RATE/TRIP		.04	.13	.05	.20	.40	.12	.12

4.2.1 Vancouver Area Transportation Suppliers

Transportation suppliers in the Vancouver area will generally benefit if information supplied by ITIS results in the public using their system more efficiently. However, it is doubtful whether these savings would translate into revenue potential to pay for a ITIS demonstration. A better measure of ITIS market potential compares the large sums that transportation suppliers now spend on public information with the equivalent cost for ITIS to provide the same service.

METRO TRANSIT OPERATING COMPANY: MTOC spends roughly 1.0 million dollars annually on telephone information services. The service is available from 7:00 a.m. to 12:00 p.m. and comprises 25 operator-answered lines. Recently, MTOC installed modern PBX equipment that automatically routes inquiries to an open line. This has dramatically reduced "lost call" rates, and increased the number of calls handled to about 3,500-4,000 on an average day. Peak frequencies of over 2,000 calls/hour are experienced. 83% of these calls are route or schedule related and could be handled by an ITIS. Participation in ITIS could also include installation of display terminals to improve the effectiveness of operator call handling.

MTOC would NOT save 83% of their telephone information service cost by subscribing to ITIS. However, routing all MTOC information calls through ITIS (with automatic transfer to MTOC of calls that ITIS cannot handle) could reduce the MTOC requirement to approximately 8-10 lines. Potential savings could amount to $300-400 thousand (1984 dollars) annually, after MTOC costs for providing route and schedule information to the ITIS Data Base.

BRITISH COLUMBIA FERRIES: B.C. Ferries spends about 1.4 million dollars annually to provide both a 24 Hours information recording and 16 Hour information/reservation lines. Call volumes reach over 26,000 and 80,000 per month respectively during the peak season. Automatic equipment distributes calls from 24 incoming lines. Operator positions vary from 7-10 to as many as 15 during the Summer. Approximately 60% of calls are for reservations, and somewhat less than one-half of the remaining information calls are inquiries about schedules or sailings on the major routes.

If ITIS handled only schedule and sailings information, and provided current information on space availability, possibly 3-5 operator positions could be eliminated, with potential savings of roughly $100 thousand (1984 dollars). Since B.C. Ferries has already automated its ferry status and reservations system, the Corporation's cost to contribute to the ITIS Data Base would be nominal.

INTERCITY BUS AND VIA RAIL: PCL 84, Greyhound, B.C. Rail and VIA Rail each maintain telephone information services. VIA Rail train arrival and departure information is a recorded message on a separate number from their toll-free information/reservation line, whereas the bus information lines are answered by personnel at the terminals. Accordingly, the advantage of providing routing, fares, schedules and arrival/departures information through ITIS would be nominal savings in telephone charges and better response to calls during busy times of day, rather than significant labour savings.

AIRLINES: Several Canadian, U.S. and foreign airlines provide information on routing, schedules, fares and flight arrival/departures through Vancouver area telephone information/reservation lines. Others maintain toll-free lines to other cities. Typically, airlines personnel involved in customer service also answer telephone inquiries, and to some extent combining these functions is regarded as a way to attract more passengers. However, a significant part of airlines staff time is spent on answering telephone inquiries that do NOT result in ticket sales. This is one reason airlines have been willing to distribute arrivals/departure and schedule information through Cable T.V. and other media.

There is interest amongst airlines in the idea of providing some information through ITIS on a shared basis, so that labour savings can be achieved without any one carrier taking away from its own sales position.

DOWNTOWN PARKING: Most off-street parking in Downtown Vancouver is provided by a few large private operators and the Downtown Parking Corporation. Smaller operators and building owners supply the remainder. A large proportion of off-street parking is "pay-by-the-hours". Most Downtown parking is within a walking radius of EXPO that has proven to be acceptable for major events. City and EXPO 86 are investigating the possibility of setting up a parking information system for the Exhibition.

ITIS could provide information about the location of off-street parking relatively easily. Referral to a City-EXPO reservation system could be done with the call logic described in Appendix A, Figure A-4. However, setting up "real-time" monitoring of reservations and availability of "by-the-hour" parking will be a significant undertaking (either within ITIS or as a referral to it), and would have to be worked out with Vancouver and EXPO officials, as well as the suppliers of off-street parking.

The market for this part of ITIS would appear to be quite large, both during EXPO 86 (up to 4,000 calls a day) and afterwards (at least 2,000 calls a day).

OTHER TRANSPORTATION SUPPLIERS: Vancouver, other municipalities and the B.C. Highways Department currently provide information about traffic, accidents, street closures, road construction and special conditions to other government agencies, the public, truckers, taxi dispatch, emergency services and to media "traffic conditions" programs. Some governments provide more of this information than others.

Radio and T.V. stations supplement this information (at considerable cost for aircraft and staff) with exclusive "skywatch" broadcasts. It is doubtful that radio and T.V. stations would give up exclusive reporting that contributes to ratings. However, there is a market potential associated with providing these media basic transportation information during rush hours that is more accurate, and less costly.

Car rental companies, taxis and other special transportation suppliers will continue to supply information to their clientele. However, by participating in ITIS, they will realize valuable advertising. It can be anticipated that if some of these suppliers are listed on ITIS (with automatic connection to reservation lines), then their competitors will follow.

Taxis, police, fire departments, commercial trucking companies and others using the Vancouver area street system may find it worthwhile to subscribe to ITIS, simply to have real-time information about traffic conditions.

4.2.2 B.C. Hospitality Industry

The hospitality industry and suppliers of special display terminal systems which distribute hospitality information are both interested in the market potential of such a system during EXPO 86. Both also have identified the benefits of combining hospitality and transportation (how to get there) information in the same display terminal network.

Information about hotels and motels, restaurants, recreational and cultural activities, entertainment and tourist attractions is available to both Vancouver residents and visitors from a variety of sources, including: direct or toll-free telephone lines to major hotels, recorded messages for restaurants and entertainment, tourist information centres and regular use of the media for paid advertising. However, B.C. does not yet have automated hospitality information, such as that provided by Teleguide or some of the other systems described in Section 3.3.2.

Conservatively, the market for a "hospitality only" special display terminal system could amount to over $200,000 a year in the Vancouver area (assuming that major hotels, restaurants and tourist attractions participate in it at rates that compare with existing systems elsewhere in North America.

Although no market information was available to gauge interest in a hospitality information system with telephone, home computer and Cable T.V. access, representatives of the industry felt the revenue potential would be significantly less for two reasons: Firstly, these access modes may not be regarded by the industry as having the necessary exposure to markets. Secondly, the menu would have to be much simpler, particularly over the telephone. A rough revenue estimate of $150-225,000 per year is used in Section 4.4 of the report, based on preliminary discussions with the industry.

4.2.3 EXPO 86 Market Potential

The EXPO Corporation is developing an information system that will describe activities on their site, accomodation and transportation services to and from the Exhibition. ITIS could interface with the EXPO information system and also complement it by a two-way menu referral. Generally, there are two EXPO-related markets for ITIS:

MORE DEMAND ON EXISTING INFORMATION SERVICES: Studies for EXPO indicate that roughly 125,000 people will visit the Exhibition on a typical day. About one-quarter of these Fair-goers will be Vancouver area residents, and the rest will be coming from out-of-town. Both will have some common transportation information needs. For example, when is the next EXPO destined bus, what is the parking situation and which traffic routes to EXPO are uncongested? In addition, visitors can be expected to ask more "how do I get there" questions. Figure 9 shows the estimated daily trips to EXPO by mode and origin, and then forecasts the additional demand for general transportation information that both visitors and local residents may have. The forecast is based on a combination of both existing and typical call rates.

Added demand for transportation information during EXPO could be significant (about 10,000 calls per day, or very roughly the same volume as MTOC and B.C. Ferries combined). At least one quarter of this demand will be an increased load on existing information services (either diminishing their responsiveness or requiring additional staffing).

NEW INFORMATION DEMANDS: Some of the inquiries shown in Figure 9 will be for information that is not now available, such as the status of parking or traffic conditions. This category of demand may not put additional strain on existing information services, but if not answered will almost certainly result in less intelligent use of the transportation system during EXPO.

4.3 Workable ITIS Configuration

The ingredients of a workable ITIS are: Information that is both in demand and available from existing data bases, enough ways for the public to access the system so that a broad market is covered, and hardware/software that is leading technology, but sufficiently proven that it will be reliable in public service.

4.3.1 What Information?

The following outline describes information for which there is a public need, and that is generally available from Vancouver area data bases for an ITIS demonstration:

GREATER VANCOUVER TRANSIT SYSTEM:

- Directions about how to get to a specific destination by transit.
- The scheduled arrival time of the next bus or ALRT train at a particular stop.
- A description of the service offered by a specific route.
- General information about fares, customer service, hours of operation and use of the transit system.

VANCOUVER TRAFFIC CONDITIONS:

- What route to take to a specific destination.
- What are the traffic conditions on a particular route.

EXPO 86 PARKING AND TRANSPORTATION DIRECTORY:

- What parking is available around EXPO at a specific time of day.
- Referral to parking reservation number.
- Service and schedules for EXPO transportation services.
- Referral to EXPO's Visitor Information System.

B. C. FERRIES INFORMATION:

- General information about ferry routes, schedules, fares and conditions of use.
- What ferry to take on a specific trip.
- Real-time information about sailings, line-ups and the availability of reservations, as well as referral to customer service.

AIRLINES AND AIRPORT INFORMATION:

- Airlines arrivals/departure information for the day.

- o Airlines routing and schedule information from Vancouver to North American destinations.

- o Referral to Airport Directory and customer service line.

- o Ground transportation from Airport, including: taxis, car rentals and referral to transit and traffic menus, as well as referral to reservation lines.

INTERCITY BUS, VIA AND B.C. RAIL:

- o General information about inter-city bus and rail schedules, fares and conditions of use, as well as referral to customer service.

- o General information about ground transportation from bus and rail depots.

- o Real-time bus and rail arrivals/departures information.

HOSPITALITY INFORMATION:

- o Directory of accommodation, entertainment, exhibits, recreation and restaurants.

- o Detailed information about establishments and events.

- o Referral to reservation and customer service lines.

- o Information about how to get to a particular establishment.

4.3.2 Terminal Devices

ITIS must be accessible to a majority of the public, if it is to be effective. This means providing as many ways to contact ITIS as practical. The telephone will be the most universal means of access to ITIS for some time. However, there are limitations to the amount and quality of information that can be provided over the telephone. Cable T.V., home computers and video display terminals are available to a smaller proportion of the general public, but can provide more and more complex information.

TELEPHONE: The review of other automated information systems showed that there are several approaches to using regular telephones as "terminals". Some are NOT PRACTICAL FOR ITIS, in the Vancouver area, including:

- Computer-Voice Interpretation: Although considerable research is being done in this field, voice interpretation is still in the developmental stage. Within the time frame for an EXPO demonstration, the computer will not be able to "understand" with accuracy the wide variety of voices and languages in the general population who would want to access ITIS.

- Block-Line Reservation: This approach requires callers to know and dial one unique telephone number for information. For example, someone wanting to find out when the next bus will arrive at their stop dials the transit information exchange (XXX), route and stop numbers (XXXX). This switches the caller to a unique line and sends a computer- compiled voice message for that stop. This approach is impractical for two reasons: It is a "one- message" system, and does not allow the caller to select various types of transportation information from a menu. Secondly, even a relatively simple menu requires reserving very large blocks of telephone lines.

- Dial (pulse) Telephone: B. C. Telephone indicates that using dial telephones (rather than Touch Tone) to over-dial menu choices will be unreliable, because of the possiblity that the over-dial will cause their switching gear to disconnect the line, or to select special customer features.

Allowing for these limitations, TOUCH TONE TELEPHONE CAN BE ONE OF THE MAIN WAYS BY WHICH CALLERS ACCESS ITIS. After reaching the ITIS number, callers will use their Touch Tone pad as a "key-board" to tell the system what information they need, choosing from a computer-compiled voice menu.

Figure 10

WORKABLE ITIS CONFIGURATION

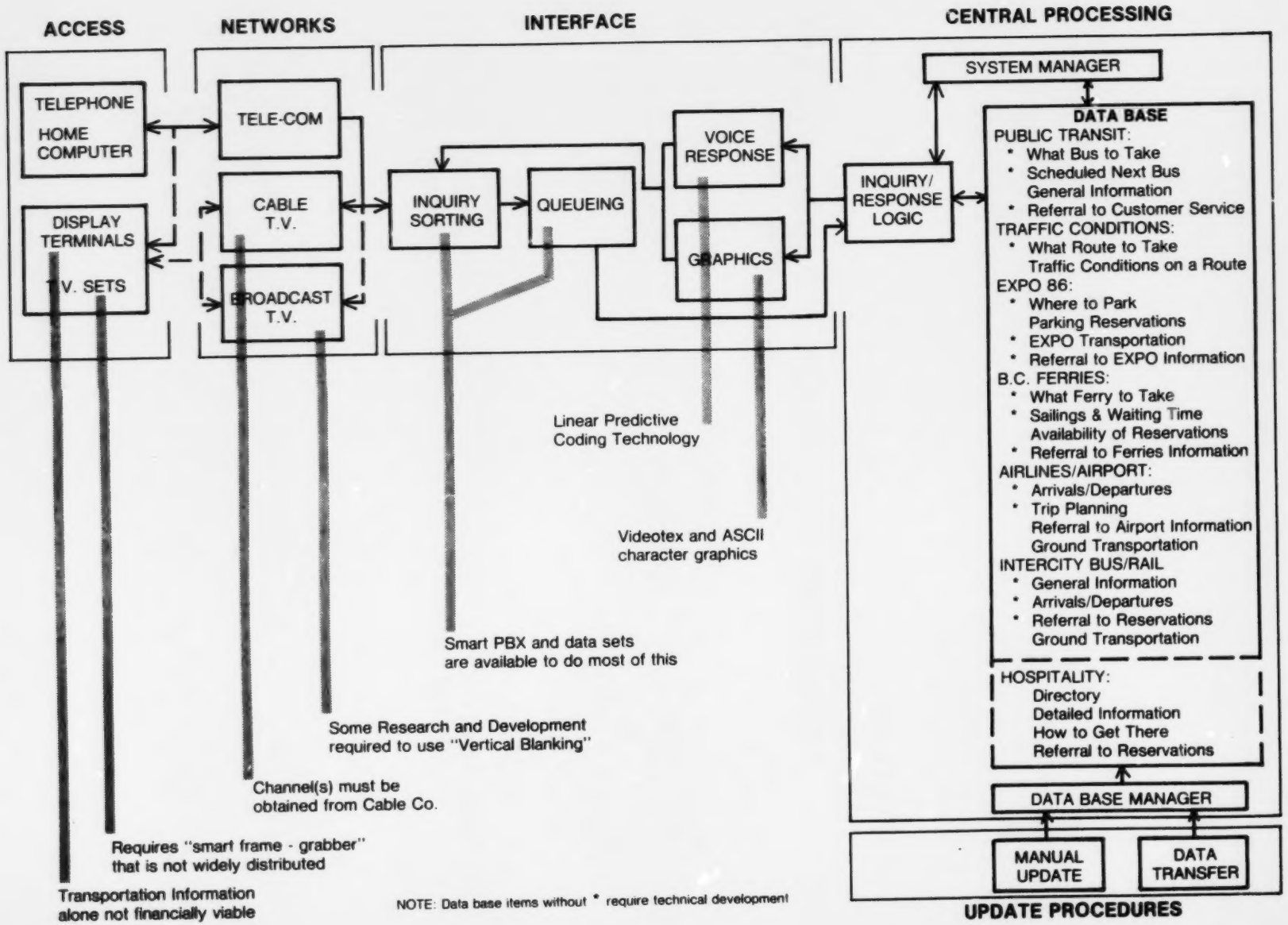


Figure 11

TOUCH-TONE TELEPHONES IN VANCOUVER AREA
(Percent of Total Installed)

AREA	EXISTING (1983)	1986 TARGETS	PERCENT INCREASE
DOWNTOWN AREA	32	41	9
OTHER VANCOUVER	22	35	13
REST OF REGION	28	40	12
CATEGORY			
MAJOR HOTELS	50	90	40
PAY TELEPHONES	60	100	40

Source: B.C. Telephone Co.

With Touch Tone telephone access, ITIS will be available to over 40% of Vancouver area residents and visitors. Figure 11 summarizes targets for Touch tone usage by the mid-1980's. The key figures for Touch tone market penetration are: Over 90% of all pay-phones, 60% of telephones in the Downtown exchange area (including most hotels and major businesses) and 40% of all telephones in the Greater Vancouver area. As Touch tone telephones come into wider use, the market penetration of ITIS will automatically increase.

(NOTE: Despite difficulties with pulse telephone over-dialing in the Vancouver area that have been identified by B.C. Telephone, the evaluation of other TIS systems suggests that it would be a good idea to try and develop this capability for applications in other cities.)

SPECIAL ITIS DISPLAY TERMINALS: Other systems place special display terminals in hotels, public buildings, airports, border crossings, bus and train depots and tourist information centres, since these are good locations to make tranportation and hospitality information available. The review of TIS systems in Section 3.3 describes both videotex and hard copy terminals.

The ITIS concept looks at a similar network of about 160 terminals distributed throughout the Lower Mainland, connected into the same central processing unit as telephone (voice) lines and other terminal devices (see Figure 12). A network approach is essential, because it enables the displays to be continually updated, provides for overall system management and allows checking of terminal operation by the host computer.

Heavy-duty video display terminals are manufactured in Canada by at least three companies: Norpac, Mitel and Electrohome. They are kiosk style, with a keyboard for the user to communicate with the system. Typically, videotex "pictures" are transmitted to the terminal from a host computer, using Telidon graphic protocols.

There is experimentation in the area of touch-sensitive terminals, which allow users to choose from the menu or show where they want to go, simply by putting a finger on a map or icon. These terminals cost more and require more maintenance. Although hard-copy terminals are used in Canada for other purposes (for example, banking) versions designed specifically for transportation applications appear to be European manufactured. These too are considerably more expensive than the video display terminals described above.

Free-standing micro-computers enclosed in a "hardened" cabinet are also available for public use. However, these are not compatible with the concept of an information system with telephone and home computer access, as well as with providing real-time information. A hybrid terminal was discussed with suppliers. It would interact with a host computer, but have the data storage and analytical features of a micro. The advantage would be that much of the inquiry logic and videotex could be stored and down-loaded from the host when the terminal is NOT in use, thereby avoiding in-use waiting that can be experienced when relatively slow host-to-terminal communication is used to generate pictures on an inquiry basis. Development work and somewhat higher terminal costs are associated with this approach.

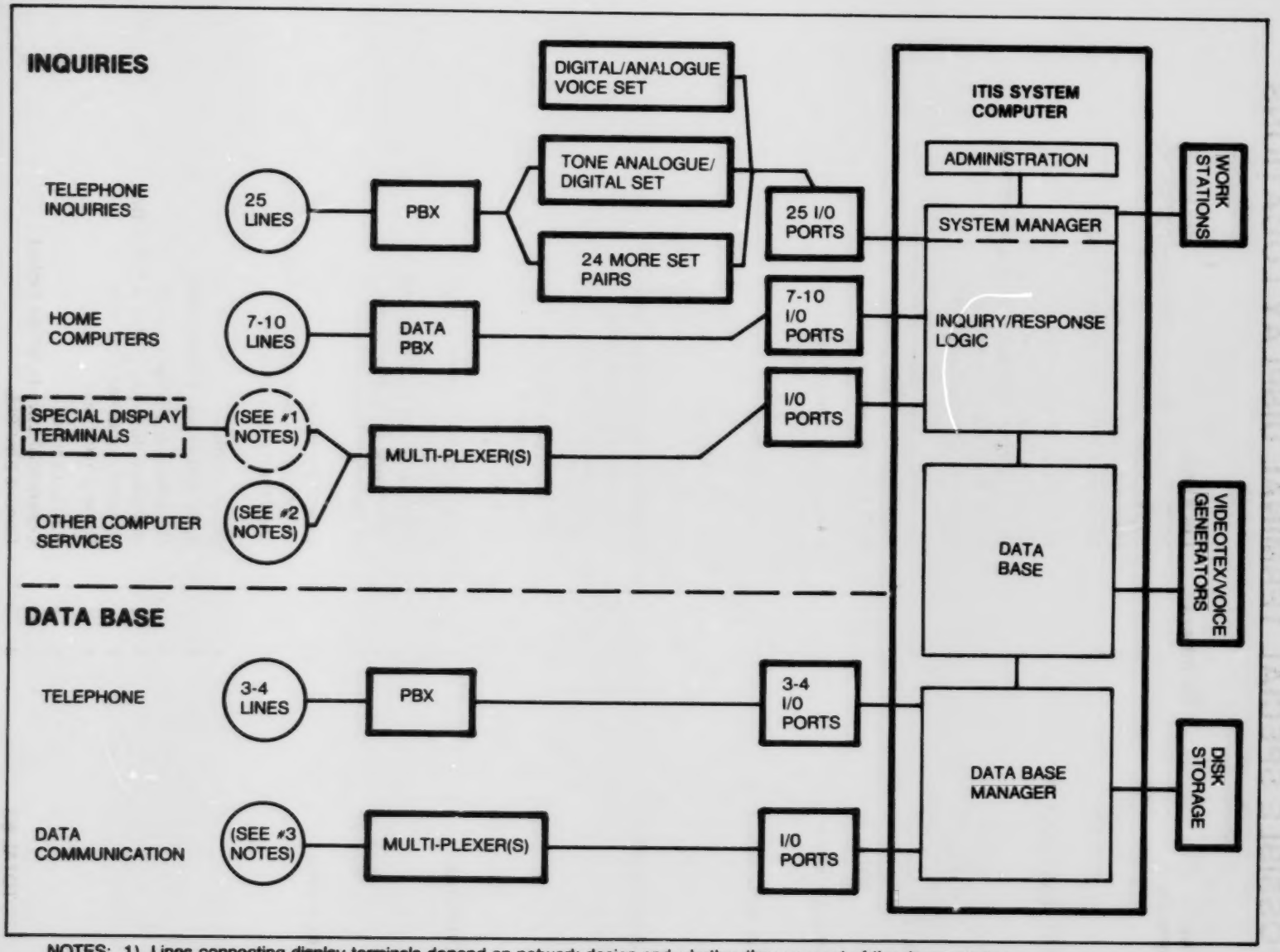
The ITIS display terminal network would serve a very different and much smaller market than the telephone (voice) access to the system. Terminals in hotels and tourist centres would serve mainly visitors to the Vancouver area, while terminals at the Vancouver International Airport, B.C. Ferry Terminals, bus and rail depots and border-crossings are accessible to both visitors and Vancouver residents already on the move.

HOME COMPUTER/COMPUTER SERVICES: In concept, a home, business or school computer with a modem could access ITIS directly (if it has the correct communication convention and gave the right password) or indirectly through a computer service network linked with ITIS.

Figure 12

POSSIBLE SPECIAL TERMINAL DISPLAY LOCATIONS

Area	Numbers	Location
BURNABY	2	North Burnaby Business District along Hastings
	4	Simon Fraser University
	2	Business District along Kingsway
TOTAL 10	2	Municipal Centre and Heritage Village
NORTHEAST SECTOR	2	Port Moody Business District
	4	Coquitlam Regional Town Centre
	2	Port Coquitlam Business District & Public Blds.
	2	North Road & Lougheed Mall
TOTAL 12	2	Coquitlam Community Centre
DELTA	4	Ladner Business District & River Inn
	2	Scott Road Business District
TOTAL 8	2	B.C. Ferries Terminal
LANGLEY AREA	2	Langley City Business District
TOTAL 4	2	Langley Municipal Airport
NEW WESTMINSTER	2	Douglas College
	2	Hotels
	2	6th & 6th Business District
TOTAL 8	2	Downtown Area & Public Buildings
NORTH SHORE	2	Horseshoe Bay Ferries Terminal
	2	Park Royal Shopping Centre
	2	West Vancouver Hotels
	2	SeaBus Terminal
	2	Lower Lonsdale Business District
	4	Upper Lonsdale Business District & Public Blds.
TOTAL 16	2	North Vancouver District
RICHMOND	8	Vancouver International Airport
	4	Airport Area Hotels
	4	Richmond Centre & Public Blds.
	2	Lansdowne Shopping Centre
TOTAL 20	2	Highway 99 Tourist Centre
VANCOUVER	22	Downtown Hotels
	12	Downtown Shopping Malls & Major Stores
	8	Downtown Public Buildings
	4	Stanley Park
	4	West End Hotels & Public Blds.
	4	Granville Island & False Creek
	6	Broadway Business District & Public Blds.
	6	University of British Columbia
	4	General West Side
	4	P.N.E. Grounds
	2	Commercial Drive Business District
TOTAL 82	4	General East Side
TOTAL 160		



NOTES: 1) Lines connecting display terminals depend on network design and whether they are part of the demonstration
2) Design of this component depend on specifics of other information services communication with ITIS
3) Design of this component depends on specifics of other data bases

Figure 13 ITS DEMONSTRATION COMPONENTS

Roughly 2-4% of Vancouver residents have access into the data communications network, either with their own home computer and modem, or through a work-station at office or school. A much larger share of the population have "second-hand" access at their place of work or study. The number of people with either direct or indirect computer access is increasing rapidly. Accordingly, home computer or computer service networks could be an increasingly important means of accessing ITIS.

General review of computer service networks in the Vancouver area indicates that there are two relatively straight-forward ways that computer access to ITIS could be provided:

- Direct access could be provided using an interface like the UBCnet "Help" menu, which enables communication with a variety of home computers and computer terminal devices.

- Two-step access could be provided to subscribers to both home and business computer service networks.

Screen listings or hard copy are the most practical forms by which ITIS could provide information, since these only require transmitting ASCII text files according to fairly common conventions. Graphic capabilities of various computers and operating systems vary widely, so ITIS would require complex software to "give users the picture", unless graphics are constructed from the standard ASCII character set.

TELEVISION: Availability of Cable T.V. throughout the Vancouver area is second only to the telephone. T.V. can communicate much more complex transportation information, "a picture is worth a thousand words." However, although the use of home T.V. as a terminal device is attractive, it depends upon availability in the home of technology for two-way communication over the cable network.

The review of this technology suggested that the first product to enter the marketplace is likely to be a "smart frame-grabber" (either NABU or some comparable product), but that this is at least a year or two away. Market penetration of more than 5-8% is unlikely by 1986.

Accordingly, one way to recognize the longer term value of T.V. as access to ITIS will be to adapt the menu structure and graphics that is developed for the special display terminals, so that it is suitable for communication over one or more cable channels, when the market has developed.

4.3.3 Basic System Architecture

Figure 13 illustrates the basic components of ITIS. These are: the terminal devices that were described above, the networks by which terminals are connected to the ITIS host computer, network-computer interface, ITIS data base, inquiry/response logic and data base management.

NETWORKS AND ITIS INTERFACE: A review of other automated information systems suggests that telephone (voice) inquiries and direct computer inquiries could come into ITIS over switched telephone lines. Display terminals could communicate with the ITIS host computer over switched, but conditioned lines. Links to other transportation data bases and computer service networks would likely be by dedicated lines. The development of this network is straightforward, and would rely primarily on the in-place B.C. Telephone telecommunications network.

The interface between ITIS and the network will combine several functions that are currently performed by other automated information systems, including:

- Acknowledge the inquiry and notify the central processesing unit (CPU) that someone wants to use the system.
- Distinguish dial and Touch Tone (voice) calls, as well as computer calls; route each to the appropriate port.
- Say "hello" or send "sorry ITIS can't help" message in the form appropriate to the terminal device.
- Queue calls, or put them through to the first open line.
- Input inquiry commands coming over the network; output transportation information from the CPU.
- Hang-up when told by the caller or the CPU that the session is finished.

To answer the inquiry frequencies summarized in Figure 16, Section 4.4.2, ITIS interface equipment will have to sort and route a peak call volume of approximately 2-3000 voice calls and 1-200 computer calls per hour coming in over regular telephone lines.

Hardware/software for computer and display terminal interface will have to handle a maximum of about 3-4,000 inquiries per hour from both the display terminal network and computer service networks. (The review of other systems suggests that interfacing between ITIS and other data bases should be separated from the inquiry interface.) The hardware/software for computer interface is generally available off-the-shelf, and could be adapted to ITIS.

Most of the hardware/software for telephone interface is available in components, for example: telephone switch gear, Touch Tone decoders, dial pulse recognition, automatic answer and disconnect and digital/analogue voice converters. However, ITIS would require developing a "package" of these components in a form that is more complex than other automatic information sytems that were reviewed.

PROGRAM STRUCTURE: Other automated transportation information systems described in Section 3 have menus and inquiry logic that vary from the complex to a simple "one-message" approach. Evaluation of these systems suggested several features that could be adapted to ITIS:

- Voice Response: Voice encoding technology used by Teleride, Hamburg AFI and several other information systems produces human quality vocabulary from which messages can be compiled. Response time is minimal, because the vocabulary is stored in RAM or on a highspeed peripheral, so that no mechanical steps are involved.

  There are suppliers of this technology in British Columbia. The hardware required to convert the digital voice message into an analogue signal and send it over the telephone line is relatively inexpensive (less than $600 per telephone line) and depends on readily available micro-chips supplied by at least three international manufacturers. The vocabulary itself would cost roughly $100-300 a word and can be supplied in standard machine readable files.

- Video Graphics: The review of other information systems identified several aspects of video graphics that could be used by ITIS. Telidon and the newer North American Presentation Level Protocal Syntax (NAPLPS) to which video suppliers are now adapting are a leading, but fully developed technology that can be used to compress and send images over existing telecommunications networks between video terminals and a host computer. Thus, most of the work involved in creating ITIS graphics for special terminal display is generation of the video pictures per se. In this area, there is scope for improvement on existing information system graphics, particularly in the area of choosing colours and sequencing, so as to minimize frame generation time.

  ITIS graphics for home computer use present a different challenge. There are a variety of devices, most with different graphics capabilities or none at all, and few capable of displaying video-graphics. Accordingly, (as mentioned in Section 4.3.2) the most practical form of graphics are patterns created from standard ASCII characters. This will mean different and simpler graphics than for special display terminals. However, there are examples of quite sophisticated ASCII character graphics.

- Inquiry and Menu Logic: Existing information systems suggest several principles for ITIS inquiry and menu logic, as well as some pitfalls:

  1) The basic principle is "keeping it simple ....." on the menu, but this paradoxically suggests more complicated inquiry logic and software for ITIS.

  2) Graphic menus currently in public use are hierarchical with as many as 5-10 levels, each having a few to a dozen or more choices. Apparently user resistance has been due not so much to this complexity, as to having to go step-by-step down the "tree" to get an answer. Desirably, users should be able to make shortcuts across menu categories, avoid preliminaries and not have to enter the same information more than once.

3) There is mixed evidence as to how complicated a workable voice menu can be. However, there are in-public-service examples of menus with at least 3-5 major categories, each with several sub-levels. "One message" voice systems, such as Teleride have complicated the "answer" to an inquiry by adding general information, bulletins and/or paid advertising.

4) Practical limits to hardware/software systems design argue against a monolithic ITIS. Rather than duplicating the information in other automated Vancouver area systems, ITIS should generally transfer inquiries to them.

5) The menu and inquiry logic for both voice and graphic parts of ITIS should protect against "hackers" and those who are only poking around, rather than making serious inquiries.

There appears to be room for improvement in both menu construction and inquiry logic. Also there appears to be no system that is designed specifically for multiple access (the Hamburg AFI system is a partial exception). For these reasons and because the menu for the Vancouver area will be somewhat unique, the demonstration design described in Section 5 envisions developing this part of the project, rather than acquiring or adopting it from an existing system.

o Response Logic: After it is notified of an inquiry, the ITIS CPU will go through several steps to provide an answer. These are essentially the same, regardless of the category of information or means of access, and include:

1) Log type of inquiry (and terminal I.D.),

2) Refer inquiry to "Help" message or to operator assistance, if it cannot be dealt with automatically (at the beginning of the inquiry if the system cannot accept the call, or during the inquiry/response sequence if the user does not provide an appropriate response),

3) Set clock, as well as appropriate pointers and flags,

4) Go through menus and display next choice,

5) Error trap,

6) Access directory information in data base,

7) Locate trip origins and destinations by zone system, using either information supplied by the user or terminal I.D.,

8) Identify trip path and calculate or access if in the data base,

9) Compile an "answer" or next choice from video frames, voice vocabulary or text files in data base,

10) Transmit the "answer" through appropriate communications port and channel,

11) Auto-dial and connect to other iformaiton systems, and

12) Terminate the exchange acording to internal criteria, or when prompted by user.

- Transportation System Logic:

  The EMME-II transportation model that is being adapted to the Vancouver area can provide much of the information required for steps 7 and 8. Some relatively simple network development will be required for inter-city trips. Determining the location of trip origins and destinations will require receiving some form of location code from the user. This is a relatively complicated feature that is not typical of existing systems; it will require innovation. Examples of most other logic steps are found in existing information systems. However, these systems are typically proprietary and have software that is written in various languages. Moreover, as discussed earlier, other software does not deal with multiple terminal devices and transportation modes. Accordingly, the ITIS project that is described in Section 5 will involve software development, using other systems as examples.

- System Management: Practical development of ITIS as an ongoing system will also require various system management functions, including: inquiry logging (for billing and use surveys), system diagnostics, data base updating procedures, accounting and system administration.

Figure 14

SUMMARY OF ITIS LOGIC

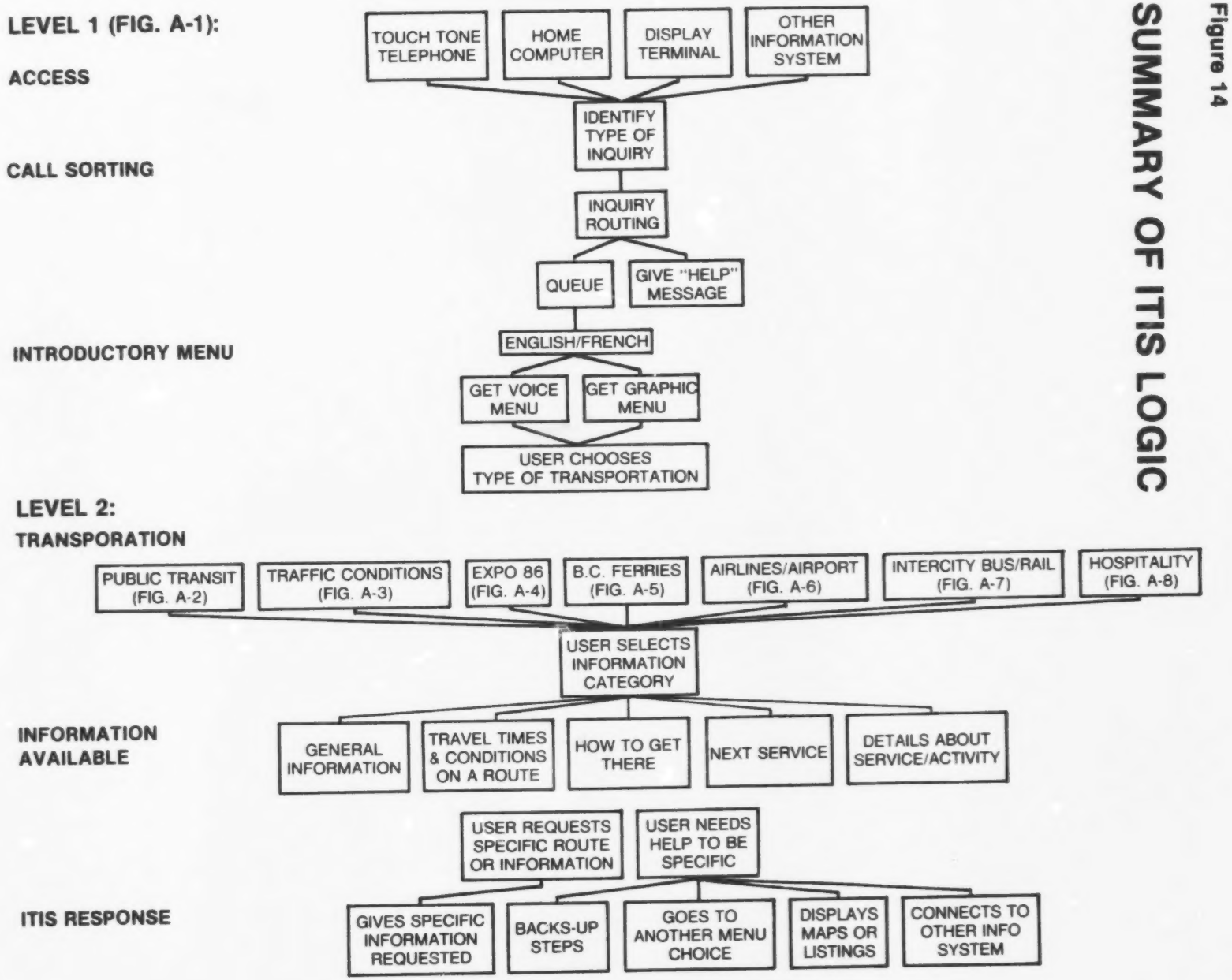


Figure 15

SUMMARY OF ITIS COSTS

SYSTEM COMPONENT:	PROTOTYPE (7 Months)	DEVELOPMENT (15 Months)	EXPO DEMONSTRATION (8 Months)	TOTALS (30 Months)
EQUIPMENT:				
Voice Component	$41,000	$99,000	$118,000	$258,000
Graphic Component	5,000	82,000	1,457,000	1,544,000
SOFTWARE:				
Menu/Display	22,000	183,000	25,000	230,000
Inquiry Logic	40,000	58,000	—	98,000
Data Management	42,000	75,000	39,000	156,000
System Management	22,000	53,000	35,000	110,000
DATA BASE DEVELOPMENT:	22,000	58,000	8,000	88,000
MARKETING:	13,000	64,000	94,000	171,000
ADMINISTRATION:	48,000	114,000	43,000	205,000
TOTALS:	**255,000**	**786,000**	**1,819,000**	**2,860,000**

NOTE: Figures are rounded and do not correspond exactly to the detailed cost breakdown in Figure 20.

4.3.4 Data Base

Most of the data base that will be needed for ITIS to supply the information described in Section 4.3.1 is available from transportation suppliers (much of it in machine-readable form). A detailed description of transportation supplier (and some hospitality) data bases is contained in Appendix B.

The general design for the ITIS data base should maintain control and provide for relatively easy updating by suppliers. It also should be structured with the purpose of easy and fast manipulation by the inquiry and response logic. These requirements will have to be reconciled with the need for some ITIS information to be "real time". In concept, this suggests one centralized data base in the host computer or its peripherals, which is updated periodically by transportation suppliers, either by giving them remote terminal access to "their" data, or by direct computer-to-computer data transfer.

In practical terms, only some "real-time" transportation information will be available for the Vancouver area by 1986. Fortunately, what will be available is generally quite useful to an ITIS demonstration:

- Arterial Street Travel-Times(Vancouver Only);
- Transit (some);
- Parking (some);
- B.C. Ferries Sailings and Reservations;
- Intercity Bus/Rail;
- Airlines.

4.4 Financial Feasibilty

4.4.1 ITIS System Costs

Costs were estimated for a Vancouver area ITIS demonstration that would be developed in three stages. (All cost estimates are in 1984 dollars and do not include financing charges.) The estimates are based generally on a review of the ITIS concept with potential suppliers, and are intentionally conservative.

The first stage (PROTOTYPE DEVELOPMENT) comprises a seven month program to develop a working concept, including "laboratory" versions of the hardware and software for both the voice and graphic parts of the system. The cost of this stage is estimated to be about $255,000. The breakdown of the estimate is shown in Figure 15.

The second stage (DEMONSTRATION DEVELOPMENT) develops the working concept into a demonstration package that is suitable for EXPO 86, including expanding the transportation data base, "scaling up" the hardware and software, obtaining participation of transportation suppliers and set-up to market the project. This stage is estimated to cost about $785,000. Roughly two thirds of the stage two cost is for the voice portion of the system, while the remainder is the estimated cost of developing the video display graphics and hardware.

Stage three comprises actually running an ITIS DEMONSTRATION for eight months, including: set-up and testing, marketing and operation during EXPO 86. The demonstration is estimated to cost roughly 1.5 million dollars. By far the largest part of this cost is the price of putting the 160 video display terminal network in place and for the telecommunications network that will be required to enable the terminals to interact with the ITIS host computer.

4.4.2 Local Revenue Potential

Figure 16 summarizes a transportation related revenue potential for ITIS in the $245,000 to $450,000 range. Revenues from the first year of a demonstration would be somewhat less. If the demonstration is operated during EXPO 86, the exposure (and willingness of transportation suppliers to invest in ITIS instead of adding to their own services on a temporary basis) could build up revenues more quickly. These estimates are conservatively based on the current demand and costs to supply transportation information discussed in Section 4.2. The lower estimate is associated with access to ITIS by telephone and possibly home computer. The higher estimate assumes multiple access, including a video display terminal network.

Combining transportation related and hospitality information revenue, income ranging from roughly $400-600,000 a year or more may be achievable. The lower estimate is associated with limited access to ITIS.

Figure 16

ITIS MARKET SURVEY

Transportation	Total Inquiries/Day (See Figures 8 & 9)	Share Of Inquiries By Device			Potential Revenue/Year (See Section 4.2)
		Telephone	Display Terminals	Computer Service	
VANCOUVER REGIONAL TRANSIT	3500—4500	95%	—	5%	$100—200,000
VANCOUVER TRAFFIC CONDITIONS	2000—3000	90	—	10	30—50,000
DOWNTOWN PARKING	1500—2000	95	—	5	20—40,000
EXPO 86 TRANSPORTATION	4000—5000	60	35	5	N.A.
TAXI AND CAR RENTAL	400—1000	50	45	5	30—50,000
B.C. FERRIES	1500—2000	75	20	5	25—50,000
INTERCITY BUS AND RAIL	500—1000	85	10	5	10—20,000
AIRLINES	1000—2000	70	20	10	30—40,000
	14,400—20,500				245—450,000
ACCOMMODATION RESTAURANTS RECREATION ENTERTAINMENT TOURIST ATTRACTIONS	10,000—15,000	10	85	5	150— 225,000
	24,400—35,500				395—675,000

Figure 17

ITIS BALANCE SHEET

(COMPARISON OF GROSS COSTS AND REVENUES, EXCLUDING FINANCE)

4.4.3 The Balance Sheet

A cash flow analysis was done to compare development and operating costs of a full ITIS system (including 160 video terminals) and transportation related revenues ONLY, for a ten year period (see Figure 17).

At the end of proto-type, development and 8 month demonstration program (30 months in total), the FULL ITIS system is estimated to cost over $2.5 million against revenues of about $130,000. The resulting net loss is $2.4 million, (or closer to $2.8 million if financing charges at current rates are included). Carrying the analysis out over ten years, the FULL ITIS SYSTEM continues in the red if its only source of revenue is transportation related. The overriding reason is the high initial and ongoing cost of the video terminals and telecommunication network.

A similar cash flow analysis for PARTIAL ITIS without the video display terminal network shows a net loss of $775 - $940,000, after 30 months depending on whether financing charges are included. However, because of much lower operating costs the more PARTIAL ITIS could start to show a profit as soon as 5-7 years after it is in public use, again depending on how financing is handled. (See Figure 17). Additional revenues from including hospitality information could shorten the time a PARTIAL ITIS would operate in the red.

4.4.4 Cost Comparison of Alternatives

ITIS COSTS PER INQUIRY: Costs of 10-15 cents per call for telephone inquiries can be calculated by relating the inquiry rates shown in Figure 16 to the cost of the voice portion of ITIS (Section 6.).

The costs per home computer and display terminal inquiry are considerably higher, ranging from approximately $1.00 - $2.00 or more respectively. The actual configuration of an ITIS system and other considerations, such as financing, will determine actual unit costs for each type of inquiry.

ITIS telephone inquiry costs are considerably less than the range of .44-$1.00 per call for other transportation information systems. The main reason is that ITIS specializes by answering calls that are suitable for automation, and therefore does not build in the cost of calls that require often lengthy person-to-person interchange.

The high costs per inquiry for home computers and special display terminals are due to the greater sophistication of the information being communicated, more complicated menu and inquiry logic, and for special display terminals the annualized cost of the terminals themselves, as well as connecting telecommunications network to the host.

ITIS VERSUS EXISTING VANCOUVER INFORMATION SYSTEMS: The voice part of ITIS has substantially lower unit costs than the rough average of $1.00 per call for Metro Transit and other major transportation information systems in the Vancouver area.

The video display terminal network involves the largest initial and ongoing costs. It is doubtful that a combined voice and video ITIS demonstration would be less expensive per call than the status quo, unless system costs are shared between transportation and hospitality inquiries.

ITIS AND OTHER MEDIA: ITIS will not replace the role for other media in communicating transportation (and hospitality) information to Vancouver area residents and visitors, particularly during EXPO 86. Ideas for new use of media or expanded use of existing media could include:

- Special Radio and T.V. Channels: During EXPO 86, "Voice of EXPO" radio and an equivalent T.V. Channel could broadcast only EXPO events, transportation conditions, and parking information, tips on accommodation, plugs for EXPO participants and "what's around town". (Undoubtedly there will be more EXPO related "spots" and features on regular channels.)

- Message Boards: Automated message boards in public places and along major transportation routes could continuously communicate traffic conditions, availability of downtown parking and other information.

- Expansion of Existing Telephone Information Systems: Increased demand for information during EXPO 86 (Section 4.2) and afterwards could pressure suppliers of existing telephone information systems to expand them.

ITIS could complement these and other media, if it specializes to provide transportation (and possibly hospitality) information that is commonly requested and somewhat changeable. For example, sharing of "pictures" between ITIS and broadcast and Cable T.V. has been discussed in several sections of the report. ITIS also could be used by printed media and radio stations as a resource; and interactively with message boards and their data bases. Section 4.5 of the report and the Appendices describe a role for ITIS that could take the expansion pressure off of existing telephone information systems by handling volume calls automatically.

5. DESIGN OF A DEMONSTRATION

5.1 Interface Architecture

5.1.1 Telephone (Voice) Inquiries

Desirably, ITIS would have a single telephone number for general public access to the voice part of the system. Demand estimates described in Section 4. suggest call frequencies peaking at one every 3-4 seconds. So that ITIS can respond without delay, roughly 20-25 telephone lines coming into the system may be required.

The call handling equipment that "fits in between" the ITIS host computer and the telecommunications network has relatively standard functions that could be performed by off-the-shelf PBX equipment, with some special equipment and corresponding communications ports into the CPU. The interface steps this call-handling equipment and software must perform are diagrammed in Appendix A-1; generally they are:

- Route the call to an open line, or give an "ITIS is busy ....." message and put the call into a queue.

- If user responds with a signal that ITIS cannot interpret (for example, a dialed pulse,) connect to an operator for assistance or to recorded "help" message.

  (NOTE: The project work program and cost estimates described in Section 6. include research on a "black box" that will interpret dial pulses and convert them to digital commands that ITIS could understand. However, B.C. Telphone indicates pulse over-dialing is not practical on their Vancouver area network.)

- If user responds with Touch Tone, notify the CPU that a call is on the line and then convert over-dialed tones to commands that drive the ITIS voice menu. (The project is developing a prototype of this equipment.)

- When the CPU has responded to an inquiry with a digital message, translate it into an analogue (voice) signal that is transmitted out over the line.

- o (If possible, the interface should allow for automatic recording of the user's telephone number, so that it can be used later on by the response logic to determine trip origins.)

- o If the user requests a referral to another information system, auto-dial it upon a command from the CPU and notify the CPU that a connection has or has not been made; then transfer or disconnect the call.

5.1.2 Asynchronous Computer Inquiries

Inquiries by home computers and computer services probably will be made to a separate ITIS telephone number. Computer calls from information suppliers to update their data base will be made to yet another number, but use essentially the same interface. It is anticipated that most computer inquiries will use the B.C. Telephone switched network.

Peak call frequencies described in Section 4. indicate 7-10 data lines, with corresponding modems and asynchronous communications ports. Equipment for this interface is available off-the-shelf. The functions the equipment and software must handle are listed in Appendix A-1, but generally include:

- o If user responds with a computer hook-up code, route the call to an asynchronous communication port or (if none is available) into a synchronous communication queue.

- o Perform standard modulation-demodulation and sign on the software in the CPU to deal with a computer inquiry.

5.1.3 Synchronous Communication

ITIS will require several synchronous ports for high-speed data links to other data bases and information systems. These include possible referral links to the EXPO 86 Information System, Canada Place and a commercial videotex hospitality information system, Metro Transit Operating Company, B.C. Ferries, airlines and UBCnet. Direct or indirect connections to North American data networks, such as Datapac and Tymenet(TM), will also be possible.

5.2 ITIS Software/Data Base

5.2.1 General Programming Approach

The ITIS programming logic and data base go hand-in-hand; both will evolve during development of the demonstration. However, this study includes a design that can be used as a start and which was used to estimate costs for the project.

The main features of ITIS software and data base include:

CENTRALIZED LOGIC AND DATA BASE: The analytical software and data base for ITIS will be centralized in one CPU with peripheral high-speed storage (See Section 5.3). This will maximize control over the system and data maintenance, as well as minimizing delays in response time due to network communication.

SELF-INITIATING ACTION FUNCTIONS: An action-oriented program structure is required to respond flexibly and quickly to users. An appropriate programming structure for this purpose will be a set of action functions kept "live" in the system, which access and manipulate the data base via a set of flags and pointers. Long calculations and analyses will be kept off-line from the user interface. This type of structure is more akin to an operating system than to more traditional, sequential or modular programming logic.

VERTICALLY STACKED RELATIONALLY LINKED DATA BASE: The type of data base that ITIS requires can be organized into a series of vertically stacked lists that are relationally organized. Operations can be performed relatively quickly by a directory system that simplifies the read-writes to addressable memory.

SEPARATE USER INTERFACE AND UPDATING SOFTWARE: The data base maintenance and updating software will be a more traditional menu controlled and modular structure. These would be kept separate from the user interface, except that program development and debug software would reside with the maintenance function and be able to assume system control and run the user interface on an interrupt basis. There will be two modes of update: a "quick and easy" mode for subscribers to update their own data and a batch mode for putting "real-time" and other large scale updates into the system.

UNIX OPERATING SYSTEM AND "C" LANGUAGE: Unix with "C" are particularly suited for this design of program structure and data base. Processing speed and adaptability of ITIS to a variety of hardware are two other significant advantages of this language and operating system.

5.2.2 Vocabulary

VOICE RESPONSE: The voice part of ITIS will use a vocabulary that is digitized and compressed using Linear Predictive Coding techniques. Appendices B and C describe the actual vocabulary in greater detail. A first estimate is roughly 20 Kilobytes of storage for each minute of conversation. Using this figure, an overall storage requirement of 1-2 megabytes may be needed for vocabulary.

VIDEOTEX: Example video graphics for special display terminals are in Appendix C. In summary, menu choices will be patterned on the transportation/hospitality symbology that is used world wide in airports and other transportation terminals. Map information will be an adaption of the most "readable" paper copy transit route diagrams and street maps. Assuming an average of 1-2 kilobytes for each video frame, roughly 3-9 megabytes will be needed for the video vocabulary.

CHARACTER GRAPHICS: Character graphics for computer service inquiries will be patterned on their "twin" video frame, but will be made up of standard ASCII characters, so as to allow paper or screen listing on a wide variety of terminal devices. Roughly 1-2 megabytes of storage has been assumed for the character graphic vocabulary.

5.2.3 Relating to Other Data Bases and Systems

5.3 Hardware Requirements

The computing equipment for TIS should be capable of performing the functions shown in Figure 13 for up to 25 voice inquiries and 10-20 computer or display terminal inquiries simultaneously.

Overall memory requirements for the data base, vocabulary and software will be roughly in the 115-200 Megabyte range. Specific hardware requirements will depend on the detailed design of the data base and software. However, costs were estimated on the basis of a "fast minicomputer", with roughly that amount of RAM, supported by hard disk and with a configuration of communications ports and interface equipment to handle the functions described in Section 5.1. There are a number of computers in this class available on the market.

Another option to be explored is configuring the CPU almost like a Local Area Network, with the most frequently used vocabulary and primary inquiry logic down-loaded to "smart" versions of the telephone interface and video display terminals. This would enable the host computer to specialize in response and system functions. (Cost estimates in Section 6. are not likely to change significantly with this option.)

5.4 Telecommunications Network

Network assumptions are based on a central location for the ITIS CPU somewhere in Vancouver's Central Broadway District.

The voice and computer service portions of ITIS will use 20-25 and 7-10 switched telephone lines for voice and data respectively. These would be leased from B.C. Telephone at business rates.

A 160 terminal special display network was included in the demonstration as an option and costed (See Figure 12). It was assumed that switched network lines would be used, with multiplexing at the terminal locations. Installation and line leasing costs that are used in Section 6 assume standard B.C. Telephone rates that are discounted by roughly 40% to approximate savings that might be realized by multiplexing and other available techniques that will be decided during detailed design.

Dedicated lines will be required for high-speed data communication between ITIS and several data bases, including the Vancouver automated traffic signal system, the MTOC master scheduling program (RUCUS), the B.C. Ferries information system, airlines data bases, the EXPO 86 site, Canada Harbour Place, UBC and others.

Figure 18

BASIC CENTRAL PROCESSING UNIT CHARACTERISTICS

FUNCTION	CAPACITY	KEY FEATURES
VOICE VOCABULARY	1—3 MEGABYTES	Fast Access Compressed Storage
VIDEOTEX FRAMES	3—8	Fast Access Compressed Storage
CHARACTER GRAPHICS	2—4	Fast Access
DATA BASE	75—125	Mixed Access and Storage
INQUIRY/RESPONSE	5—10	On-line Processing Multi-tasking
DATA BASE MANAGER	1—3	Off-line Processing Multi-tasking
SYSTEM MANAGER	2—5	On-line Diagnostics System Operation Off-line Processing
ADMINISTRATION	1—2	Off-line and Separate Processing
EXPANSION/FLEXIBILITY	25—40	More Fast Access Storage Flexibility to Expand Inquiry/Response Contingency

6. PUTTING ITIS IN PLACE

6.1 Work To Be Done

The four step ITIS Project (prototype, development, EXPO demonstration and production) involves "packaging" technology in an innovative way, a large part of which is available. Some new development will be needed, particularly in the area of system programming and for equipment at the telecommunications/computer interface. Thus, ITIS falls into an area between pure research and a straight-forward production exercise.

Given the tight time-table for an EXPO 86 demonstration of ITIS, it will be necessary to deal with the unknowns that are involved by developing the "package" in the shop, rather than as a theoretical design exercise. This also permits greater inventiveness. Clear product objectives for each of the four stages will make it possible to determine whether it is worthwhile to proceed from one stage to the next.

6.1.1 Prototype

A seven month prototype stage could develop a "working model" of ITIS, conduct more detailed market studies and seek precommitment from transportation suppliers to participate in the demonstration.

The system development work would involve:

MENU/INQUIRY LOGIC: Mocking up the complete voice and graphic menues;

INITIAL SOFTWARE DEVELOPMENT: Programming all the inquiry and response logic for a "model" that can handle telephone, home computer and video display terminals, (but for only a few inquiries at a time);

DATA COLLECTION: Putting together a prototypical data base that (although it will not be comprehensive) establishes the format and determines the eventual amount of information required to answer every inquiry);

MARKETING: Making more detailed surveys of potential ITIS use and call frequencies; contacting the major transportation suppliers described in Section 4.2.1 and others, to seek their pre-commitment to participate in the demonstration, and

OTHER WORK: Developing and testing the laboratory version of new equipment; administrating and seeking support for development of the demonstration (stage 2). (Opportunities for joint-use of a Vancouver area video display terminal network on a commercial basis for both transportation and hospitality information will also be explored at this stage).

6.1.2 System Development

The assessment of the ITIS prototype and market reaction described above will determine whether it is worthwhile to proceed to system development (Stage 2).

If it is decided to proceed several major work streams are required to develop a working ITIS demonstration, including:

RESPONSE LOGIC: Developing and debugging software for ITIS to respond to multiple inquiries;

SYSTEM AND DATA BASE MANAGEMENT: Designing and programming system management (administration, billing, etc.) and data base management for the full-scale ITIS demonstration, as well as setting up referral procedures between ITIS and other information systems;

HARDWARE CONFIGURATION: Testing operation of full system software on the CPU, and two step development of the computer/telecommunications interface equipment to handle multiple inquiries;

DATA BASE DEVELOPMENT: Setting up the full-scale data base; making arrangements with transportation suppliers and others for ongoing data base care and feeding;

PRE-SALES AND ADVERTISING: Refining both the ITIS menu and market estimates by using the prototype on a sample of users; obtaining final supplier commitments to participate in the demonstration and putting together the advertising program;

OTHER WORK: Ongoing administration, as well as making all of the arrangements for the demonstration.

6.1.3 ITIS Demonstration

The full ITIS demonstration will combine Vancouver area-wide telephone and home computer information, as well as about 160 special display terminals and an exhibition(s) on the EXPO 86 site. Those with a T.V. set and frame grabber could also use ITIS. In the event that some parts of ITIS are not ready by the Spring of 1986, the modular design of the project will enable the other parts to proceed.

TELECOMMUNICATIONS AND DISPLAY TERMINALS: Setting up the telecommunications network and display terminal system, as well as a two month pre-testing of ITIS before it opens to the public;

EXPO 86 EXHIBIT: Setting up and operating an illustrative exhibit (or exhibits) of ITIS on the EXPO site;

ADVERTISING AND MARKETING CAMPAIGN: Informing Vancouver area residents and visitors about ITIS; promoting its use during EXPO and exploring international markets during the Exhibition; and

OTHER WORK: Administering and monitoring the project.

6.2 Schedule

The tight, but workable schedule for an ITIS demonstration allows seven months for prototype, 15 months for development and eight months for the demonstration (including two months of trials before ITIS goes public). Figure 19 is a schedule that details the work described above.

6.3 Organization

6.3.1 Objectives

The organization for the project should be determined by its objectives. These are:

- To pull together a complex and diverse mix of available and soon-to-be-available hardware and software from the telecommunications and transportation fields into the ITIS "package",

- To keep high standards of quality control and testing throughout product development; to keep expectations within an achievable program,

- To meet a tight time-table,

- To maintain a lean program that develops and markets the product as cost-effectively and efficiently as possible,

- To obtain adequate financing for product development and marketing, both for the demonstration and world wide application stages,

- To maintain a strong entrepreneurial emphasis and use both B.C. and Canadian technology as much as possible, and

- To make maximum use of EXPO 86 as a catalyst, both for exposure to world markets and to get supplier interest.

6.3.2 Approach

Neither making ITIS a government research project nor contracting to existing suppliers is is the best way to achieve these objectives.

- ITIS is a package that cannot be delivered "off-the-shelf" by existing suppliers in Canada. Assigning the project to a supplier who currently produce only one of its components runs the risk that ITIS objectives will get lost or changed in relation to that supplier's corporate objectives and established product line.

- Making ITIS a government research project could mean losing those objectives that require an entrepreneurial emphasis.

Therefore, the most appropriate organization for ITIS appears to be the formation of a development and marketing venture, taking advantage of one or more of the government programs that support high technology product development.

Figure 19 ITIS DEMONSTRATION WORK PROGRAM AND SCHEDULE

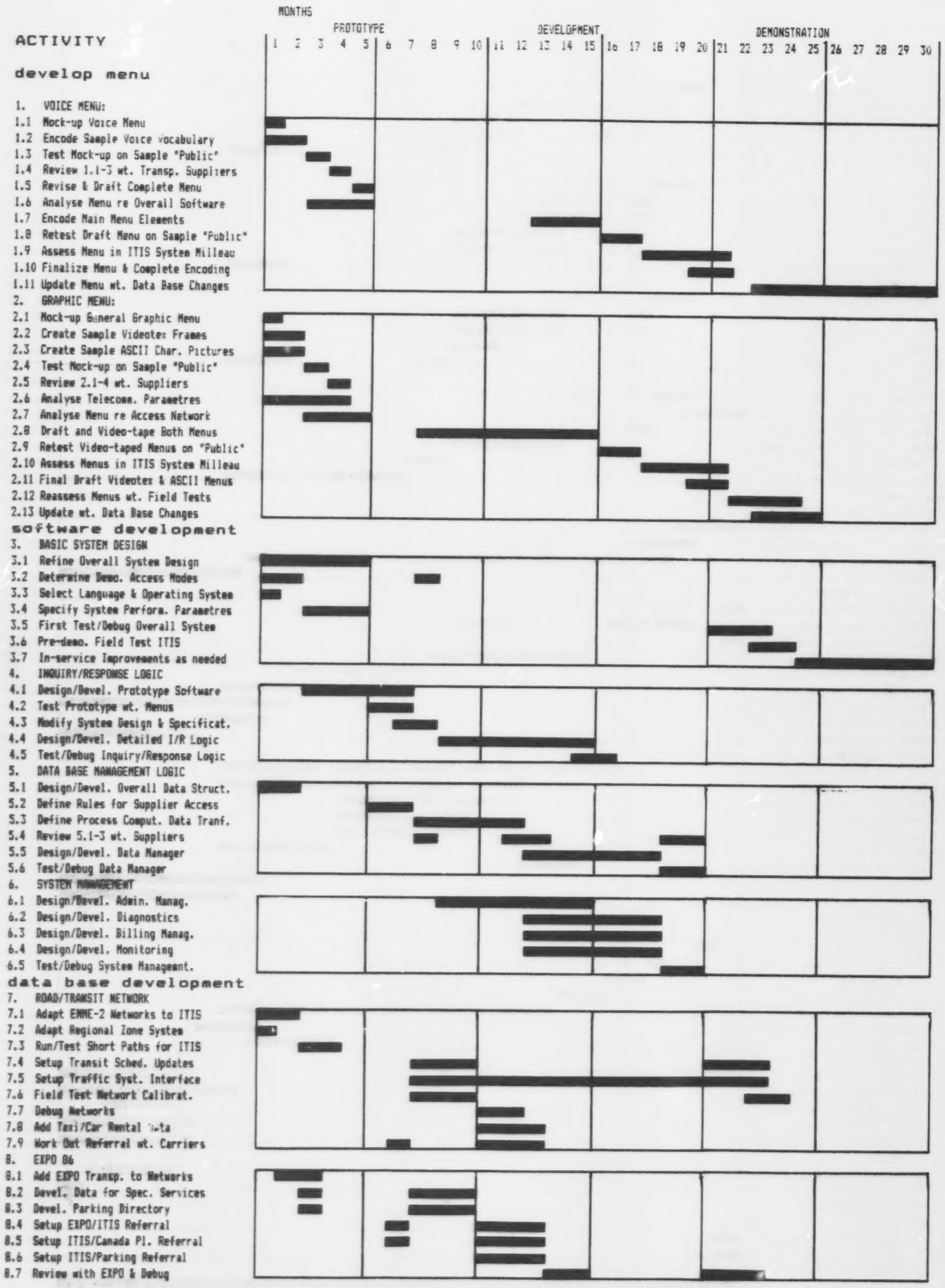

MONTHS
PROTOTYPE
DEVELOPMENT
DEMONSTRATION
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
ACTIVITY
develop menu
1. VOICE MENU:
1.1 Mock-up Voice Menu
1.2 Encode Sample Voice Vocabulary
1.3 Test Mock-up on Sample "Public"
1.4 Review 1.1-3 wt. Transp. Suppliers
1.5 Revise & Draft Complete Menu
1.6 Analyse Menu re Overall Software
1.7 Encode Main Menu Elements
1.8 Retest Draft Menu on Sample "Public"
1.9 Assess Menu in ITIS System Milieau
1.10 Finalize Menu & Complete Encoding
1.11 Update Menu wt. Data Base Changes
2. GRAPHIC MENU:
2.1 Mock-up General Graphic Menu
2.2 Create Sample Videotex Frames
2.3 Create Sample ASCII Char. Pictures
2.4 Test Mock-up on Sample "Public"
2.5 Review 2.1-4 wt. Suppliers
2.6 Analyse Telecomm. Parametres
2.7 Analyse Menu re Access Network
2.8 Draft and Video-tape Both Menus
2.9 Retest Video-taped Menus on "Public"
2.10 Assess Menus in ITIS System Milieau
2.11 Final Draft Videotex & ASCII Menus
2.12 Reassess Menus wt. Field Tests
2.13 Update wt. Data Base Changes
software development
3. BASIC SYSTEM DESIGN
3.1 Refine Overall System Design
3.2 Determine Demo. Access Modes
3.3 Select Language & Operating System
3.4 Specify System Perform. Parametres
3.5 First Test/Debug Overall System
3.6 Pre-demo. Field Test ITIS
3.7 In-service Improvements as needed
4. INQUIRY/RESPONSE LOGIC
4.1 Design/Devel. Prototype Software
4.2 Test Prototype wt. Menus
4.3 Modify System Design & Specificat.
4.4 Design/Devel. Detailed I/R Logic
4.5 Test/Debug Inquiry/Response Logic
5. DATA BASE MANAGEMENT LOGIC
5.1 Design/Devel. Overall Data Struct.
5.2 Define Rules for Supplier Access
5.3 Define Process Comput. Data Tranf.
5.4 Review 5.1-3 wt. Suppliers
5.5 Design/Devel. Data Manager
5.6 Test/Debug Data Manager
6. SYSTEM MANAGEMENT
6.1 Design/Devel. Admin. Manag.
6.2 Design/Devel. Diagnostics
6.3 Design/Devel. Billing Manag.
6.4 Design/Devel. Monitoring
6.5 Test/Debug System Management.
data base development
7. ROAD/TRANSIT NETWORK
7.1 Adapt EMME-2 Networks to ITIS
7.2 Adapt Regional Zone System
7.3 Run/Test Short Paths for ITIS
7.4 Setup Transit Sched. Updates
7.5 Setup Traffic Syst. Interface
7.6 Field Test Network Calibrat.
7.7 Debug Networks
7.8 Add Taxi/Car Rental Data
7.9 Work Out Referral wt. Carriers
8. EXPO 86
8.1 Add EXPO Transp. to Networks
8.2 Devel. Data for Spec. Services
8.3 Devel. Parking Directory
8.4 Setup EXPO/ITIS Referral
8.5 Setup ITIS/Canada Pl. Referral
8.6 Setup ITIS/Parking Referral
8.7 Review with EXPO & Debug

Figure 19

WORK PROGRAM AND SCHEDULE CONTINUED

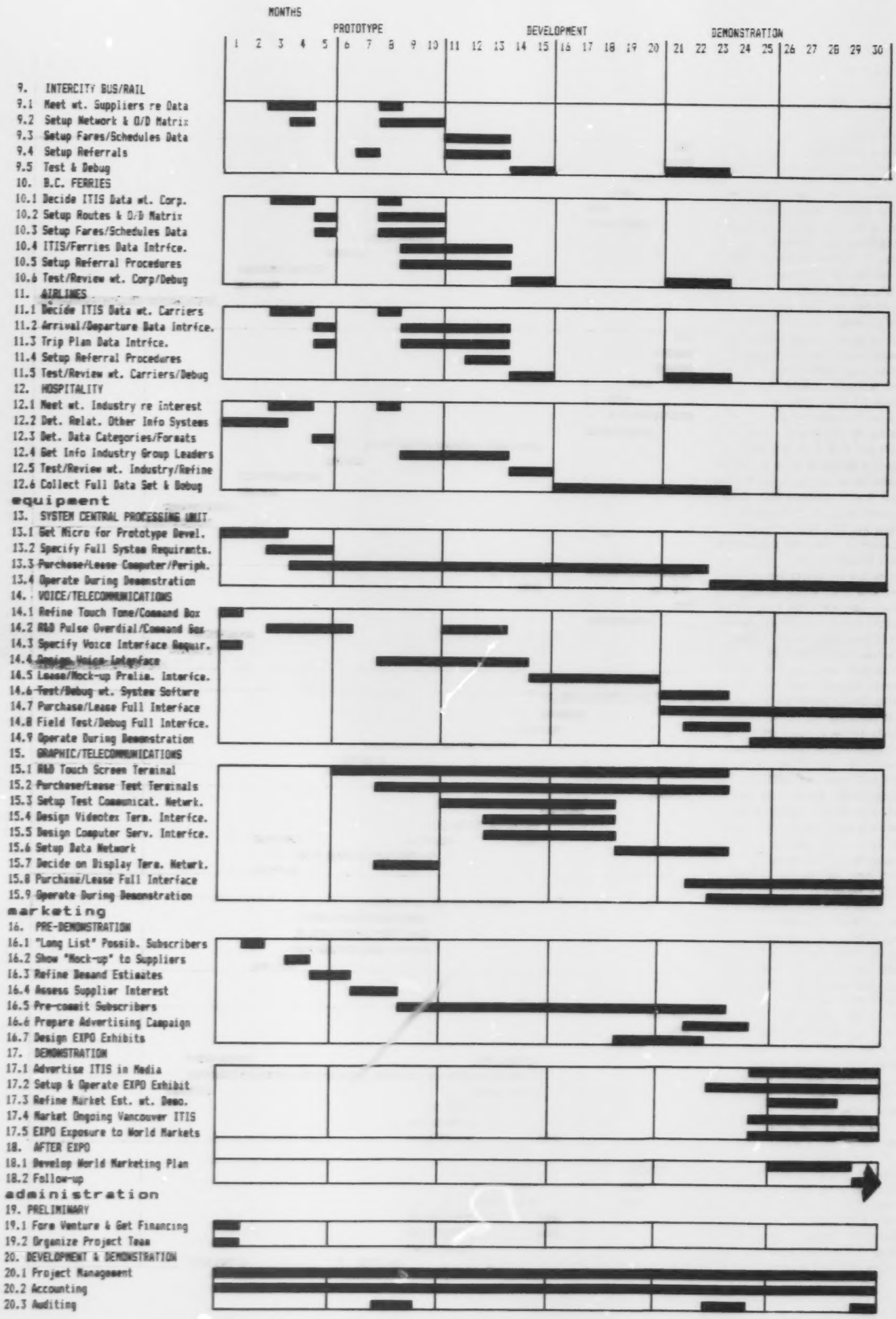

MONTHS
PROTOTYPE
DEVELOPMENT
DEMONSTRATION
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
9. INTERCITY BUS/RAIL
9.1 Meet wt. Suppliers re Data
9.2 Setup Network & O/D Matrix
9.3 Setup Fares/Schedules Data
9.4 Setup Referrals
9.5 Test & Debug
10. B.C. FERRIES
10.1 Decide ITIS Data wt. Corp.
10.2 Setup Routes & O/D Matrix
10.3 Setup Fares/Schedules Data
10.4 ITIS/Ferries Data Intrfce.
10.5 Setup Referral Procedures
10.6 Test/Review wt. Corp/Debug
11. AIRLINES
11.1 Decide ITIS Data wt. Carriers
11.2 Arrival/Departure Data Intrfce.
11.3 Trip Plan Data Intrfce.
11.4 Setup Referral Procedures
11.5 Test/Review wt. Carriers/Debug
12. HOSPITALITY
12.1 Meet wt. Industry re Interest
12.2 Det. Relat. Other Info Systems
12.3 Det. Data Categories/Formats
12.4 Get Info Industry Group Leaders
12.5 Test/Review wt. Industry/Refine
12.6 Collect Full Data Set & Debug
equipment
13. SYSTEM CENTRAL PROCESSING UNIT
13.1 Get Micro for Prototype Devel.
13.2 Specify Full System Requirments.
13.3 Purchase/Lease Computer/Periph.
13.4 Operate During Demonstration
14. VOICE/TELECOMMUNICATIONS
14.1 Refine Touch Tone/Command Box
14.2 R&D Pulse Overdial/Command Box
14.3 Specify Voice Interface Requir.
14.4 Design Voice Interface
14.5 Lease/Mock-up Prelim. Interfce.
14.6 Test/Debug wt. System Software
14.7 Purchase/Lease Full Interface
14.8 Field Test/Debug Full Interfce.
14.9 Operate During Demonstration
15. GRAPHIC/TELECOMMUNICATIONS
15.1 R&D Touch Screen Terminal
15.2 Purchase/Lease Test Terminals
15.3 Setup Test Communicat. Network.
15.4 Design Videotex Term. Interfce.
15.5 Design Computer Serv. Interfce.
15.6 Setup Data Network
15.7 Decide on Display Term. Network.
15.8 Purchase/Lease Full Interface
15.9 Operate During Demonstration
marketing
16. PRE-DEMONSTRATION
16.1 "Long List" Possib. Subscribers
16.2 Show "Mock-up" to Suppliers
16.3 Refine Demand Estimates
16.4 Assess Supplier Interest
16.5 Pre-commit Subscribers
16.6 Prepare Advertising Campaign
16.7 Design EXPO Exhibits
17. DEMONSTRATION
17.1 Advertise ITIS in Media
17.2 Setup & Operate EXPO Exhibit
17.3 Refine Market Est. wt. Demo.
17.4 Market Ongoing Vancouver ITIS
17.5 EXPO Exposure to World Markets
18. AFTER EXPO
18.1 Develop World Marketing Plan
18.2 Follow-up
administration
19. PRELIMINARY
19.1 Form Venture & Get Financing
19.2 Organize Project Team
20. DEVELOPMENT & DEMONSTRATION
20.1 Project Management
20.2 Accounting
20.3 Auditing

Figure 20

DETAILED ITIS COST BREAKDOWN

SYSTEM COMPONENT	PROTOTYPE (seven months)	DEVELOPMENT (fifteen months)	EXPO DEMONSTRAT. (eight months)	TOTAL PROJECT
EQUIPMENT (VOICE)	40,500	99,000	117,500	257,000
Analogue Overdial/Code	15,000	30,000		45,000
Analogue Touch/Code	1,000	10,000		11,000
Digital Voice/Analogue	500	2,000	12,500	15,000
Exchange/Switching	4,000	15,000	25,000	44,000
Computer/Periph.	20,000	42,000	64,000	126,000
Phone Trunk Lines			16,000	16,000
EQUIPMENT (GRAPHIC)	5,500	82,000	1,457,200	1,544,700
General Use Video Term.		12,000	948,000	960,000
Touch Screen Feature		50,000	100,000	150,000
Digital Interface/Switch	5,500	20,000		25,500
Network			409,200	409,200
SOFTWARE (VOICE)	67,800	223,700	23,000	314,300
Menu Structure/Vocabulary	14,000	165,000	0	179,000
Inqui / Logic	21,500	25,000	0	46,500
Data B se Management	32,100	33,700	23,000	88,800
SOFTWARE (GRAPHIC ADDED)	57,000	144,600	75,500	277,100
Video-frame Development	7,500	18,500	25,000	51,000
Inquiry Logic	18,500	32,500		51,000
Data Base Management	9,500	41,000	16,000	66,500
System Management	21,500	52,600	34,500	108,600
DATA BASE DEVELOPMENT	22,000	58,200	7,500	87,700
Road/Transit Network	6,600	18,200	3,000	27,800
EXPO 86	4,600	6,000	1,000	11,600
Intercity	1,900	3,000	400	5,300
B.C. Ferries	2,500	8,000	600	11,100
Airlines	3,600	10,000	500	14,100
Hospitality	2,800	13,000	2,000	17,800
MARKETING	13,000	64,100	93,500	170,600
Get Supplier Participation	13,000	64,100	25,500	102,600
Public Advertising			43,000	43,000
Special Displays			25,000	25,000
ADMINISTRATION	48,200	113,900	42,500	204,600
Office & Equipment	8,400	18,000	9,600	36,000
Travel/Communication	3,500	13,000	4,000	20,500
Supplies	3,500	4,500	1,600	9,600
Salaries	27,800	70,400	17,300	115,500
Accounting	5,000	8,000	10,000	23,000
TOTAL COST ESTIMATE	253,800	785,500	1,816,700	2,856,000

Figure 21

MONITORING CRITERIA

CATEGORY		DESCRIPTION
1. SYSTEM		
	1.1 DEMAND	1.1.1 Need for Transportation Information
		1.1.2 Availability of ITIS to Potential Users
		1.1.3 ITIS Use Compared to Existing Information Systems
	1.2 WORKABILITY	1.2.1 Useability of ITIS
		1.2.2 Availability of Components
		1.2.3 Reliability
		1.2.4 Servicability
	1.3 FINANCIAL FEASIBILITY	1.3.1 ITIS Costs Compared to Similar Systems
		1.3.2 ITIS Net Costs and Commercial Viability
		1.3.3 ITIS Revenue Potential Compared to Similar Systems
	1.4 PRODUCT DEVELOPMENT	1.4.1 Canadian and World Markets for ITIS
		1.4.2 Buyer Interest in ITIS vs. Similar Systems
		1.4.3 Canadian and B.C. Content
		1.4.4 Spin-off Product Potential (As per 1.4.1-3)
2. GENERAL		
	2.1 TRAVEL TIMES	2.1.1 ITIS Effect on Travel Times of its Users
		2.1.2 ITIS Effect on General Corridor Travel Times
	2.2 TRANSPORT COSTS	2.2.1 ITIS Effect on Congestion Related Costs to Residents
		2.2.2 ITIS Effect on Costs/Revenues for Visitor Transport
		2.2.3 ITIS Effect on Commercial Transport Time and Costs
	2.3 ENERGY CONSUMPTION	2.3.1 ITIS Effect on Petroleum Consumption
		2.3.2 Indirect ITIS Effects on Other Energy Consumption
	2.4 OTHER	2.4.1 ITIS Effect on Response Time for Emergency Services
		2.4.2 Value of ITIS as Data Base for Business/Government
		2.4.3 Advertising Value of ITIS to Hospitality Industry
		2.4.4 Other General Costs/Benefits

To maintain continuity between the four stages of the ITIS project, such a venture could be set up as a company at the outset. Its skills should be managerial, entrepreneurial, and technical in transporation, as well as communications software and hardware development.

6.4 Costs

Estimates of staffing, equipment and operating expenses were made for each stage of the ITIS demonstration described in Section 5, and based on the organizational approach discussed above.

The cost of stages one and two are, respectively $254,000 and $786,000. The cost of running the ITIS demonstration for a six month period during EXPO 86 is estimated to be $1,817,000, for a total project cost of about $2,856,000 (numbers are rounded to nearest $1,000 and may not total).

Figure 20 breaks down and charts these costs over the 30 month term of the project. The costs shown are in 1984 dollars, and include financing charges at 12% as a separate item.

7. A MONITORING PROGRAM

7.1 Purpose

The purpose of a monitoring program is to determine how ITIS performs, both generally and compared to costs and benefits that the project is estimated to have. A good monitoring program will be a sound basis upon which to decide whether ITIS should continue to operate in the Vancouver area. It will also provide useful information for marketing ITIS in other urban areas and applications.

7.1.1 Other Potential Benefits

The evaluation of ITIS in Section 4. compared it with other automated information systems and with the way that information is a currently provided in the Vancouver area, according to the rather narrow criteria of demand, workability, cost/revenue and potential for product development. However, ITIS may have much broader benefits, if it results in more informed and effective use of the over all transporation system by area residents, visitors, taxis, delivery services, truckers and emergency services.

ITIS benefits related to intercity travel have not been assessed. Inside the Vancouver metropolitan area, over 2.5 million trips are made on a average weekday. One third of these occur in the peak traffic periods. Only a very small percentage of the people making these trips will use ITIS. However, when their individual savings are added up throughout the transportation system and calculated yearly, they could exceed the comparable annual cost of ITIS.

TRAVEL TIME SAVINGS: Traffic counts carried out in recent years on major streets in the Vancouver area show a 20-30 percent variability in traffic on the main commuter routes during rush hours. By helping commuters pick the best route each work day, ITIS could save those who use it 5-10% of their usual trip time. Direct time savings could conservatively amount to 200-300,000 hours a year. By redistributing its users to other routes, ITIS could indirectly achieve overall traffic time savings of another .5-1.0 million hours.

TRANSPORTATION COST SAVINGS: Commuters could save up to $250,000 per year in fuel costs related to overall traffic redistribution. Fuel and time savings for commercial carriers could total $300-450,000 by direct subscription to ITIS. A one percent increase in non-peak transit ridership could amount to a $100-200,000 reduction to the government subsidy needed to operate Metro Transit and the West Vancouver bus system. Other cost savings related to accident reduction, faster emergency response, changes in traffic management and parking regulations, etc. have not been estimated.

ENERGY SAVINGS: Applying typical urban fuel consumption rates to the theoretical time savings outlined above indicates that at least 2.5 million gallons of gasoline and diesel fuel could be saved by ITIS each year.

7.1.2 Methodology

CRITERIA: The program should monitor and evaluate the performance of ITIS, both in relation to the broad criteria roughed out above, and the more specific criteria discussed in Section 4. Figure 21 outlines a combined list of criteria that could be used.

APPROACH: The program could provide a "before and after" comparison in three general ways:

1) Performance Audit: A comparison of ITIS usage, cost and revenues during the demonstration with detailed performance targets for these criteria that would be established during the development stage of the project.

2) User Surveys: A survey of a statistical sample of Vancouver residents conducted BEFORE the demonstration, will determine their travel characteristics. The survey would ask questions regarding: demographics, travel times and distance by purpose and mode, trip frequencies and present use of transportation information. A seminar "before" survey will be conducted of visitors to the Vancouver area.

The resident sample could be split into two groups: a control group and a second that agrees to use ITIS during the demonstration. Follow-up surveys of these groups toward the end of the demonstration could compare the two with regard to awareness and use of ITIS, as well as effect on travel characteristics. A comparative survey of visitors during the demonstration could provide similar "after" information for this group.

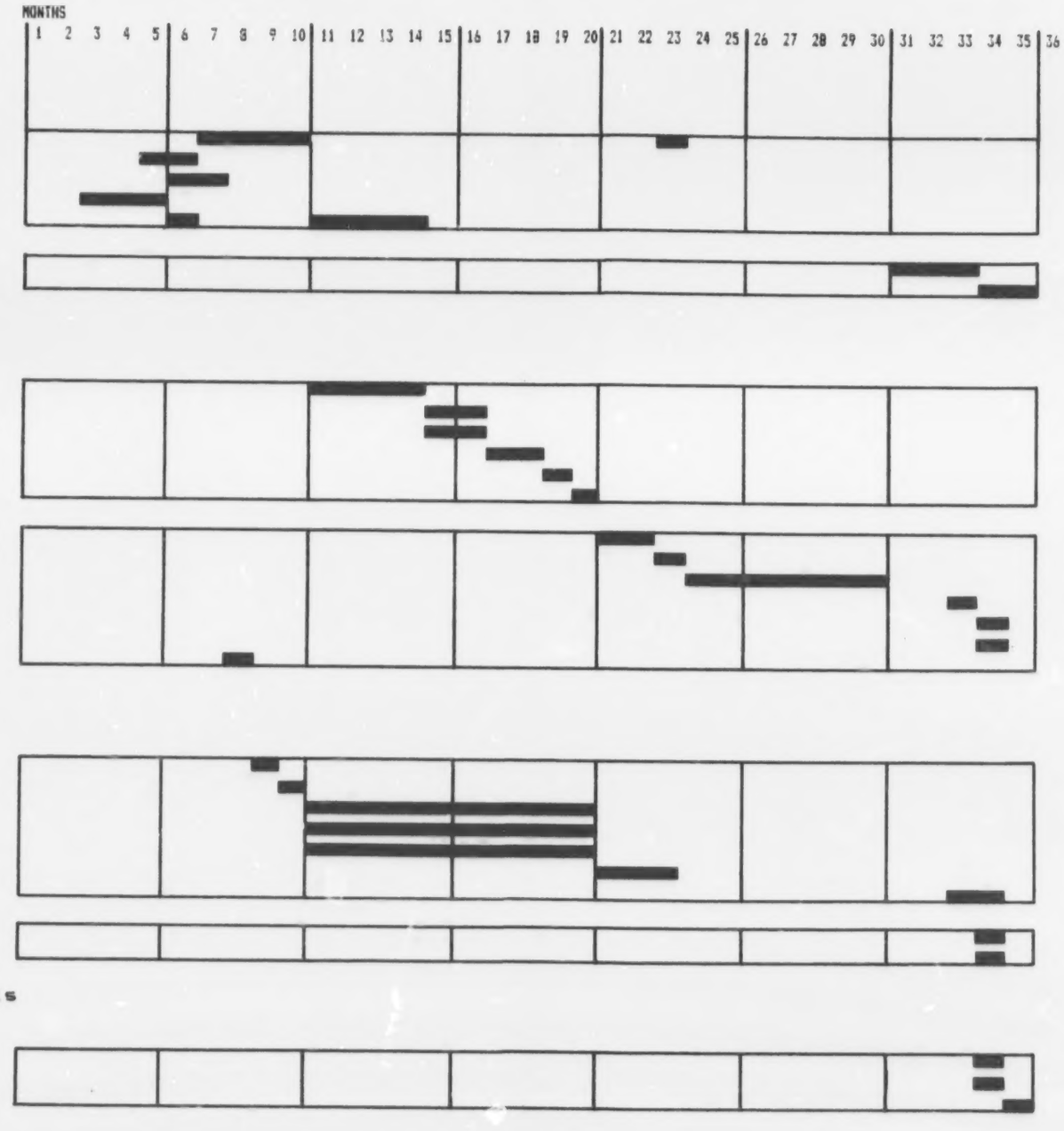
3) Corridor Transportation Analysis: This analysis would pick a major travel corridor or corridors, since an overall evaluation of the Vancouver area would be very costly. Existing traffic counts, transit ridership statistics and travel time information would be supplemented by spot checks to develop a "before" profile of travel characteristics.

   However, an "after" survey of major travel corridors during EXPO would be meaningless, as millions of people moving to and from the Exhibition distort the result. Accordingly, these follow-up surveys would have to be conducted as soon as travel patterns are no longer affected by the Exhibition.

7.2 Work Program and Schedule

Figure 22 is a suggested work program and schedule for the monitoring program. The program must start during the development stage of the main ITIS project, so as to collect base-line data. It is estimated to cost approximately $50-60,000 for the performance audit and user survey respectively, and another $40-$50,000 for the corridor analysis (excluding the cost of keeping ITIS in operation after EXPO).

Figure 22 **MONITORING WORK PROGRAM AND SCHEDULE**



ACTIVITY

performance audit

1. PRELIMINARY
1.1 Develop Project Cost Targets
1.2 Refine ITIS Demand Targets
1.3 Devel. Specific Revenue Est.
1.4 Devel. "Useability" Criteria
1.5 Prepare Audit Plan
2. AFTER DEMONSTRATION
2.1 Compare "Actuals" to Targets
2.2 Prepare Monitoring Report

user survey

3. "BEFORE" SURVEY
3.1 Review Existing Travel Surveys
3.2 Prepare Survey Plan
3.3 Select Sample "Public" (Resid.)
3.4 Select Visitors Sample
3.5 Conduct Before Survey
3.6 Compile Results
4. DURING & AFTER DEMONSTRATION
4.1 Divide Sample: Active & Control
4.2 Setup Reporting for (A) Actives
4.3 Instruct (A)'s re ITIS Use
4.4 Monitor (A) Group during Demo
4.5 Re-survey (C) Group after Demo
4.6 Results re Fig. 21 Criteria
4.7 Split Out Corridor Results

corridor analysis

5. SET-UP CORRIDOR ANALYSIS
5.1 Review Regional Transp. Data
5.2 Select Corridors for Monitor
5.3 Compile Exist. Corridor Data
5.4 Conduct Traffic Surveys
5.5 Conduct Transit Surveys
5.6 Conduct Travel Time Surveys
5.7 Do Pre-Demo Corridor Profile
6. AFTER CORRIDOR RESULTS
6.1 Repeat Corridor Surveys
6.2 Est. ITIS Impacts re Fig. 21

put together results

7. COMPILE RESULTS
7.1 Est. Awarness of ITIS
7.2 Est. ITIS Use by Public
7.3 Analyse ITIS Costs/Benefits
8. PRODUCE MONITORING REPORT

APPENDIX A

INQUIRY - RESPONSE LOGIC

Figure A-1

LEVEL 1 = INTRODUCTORY MENU LOGIC

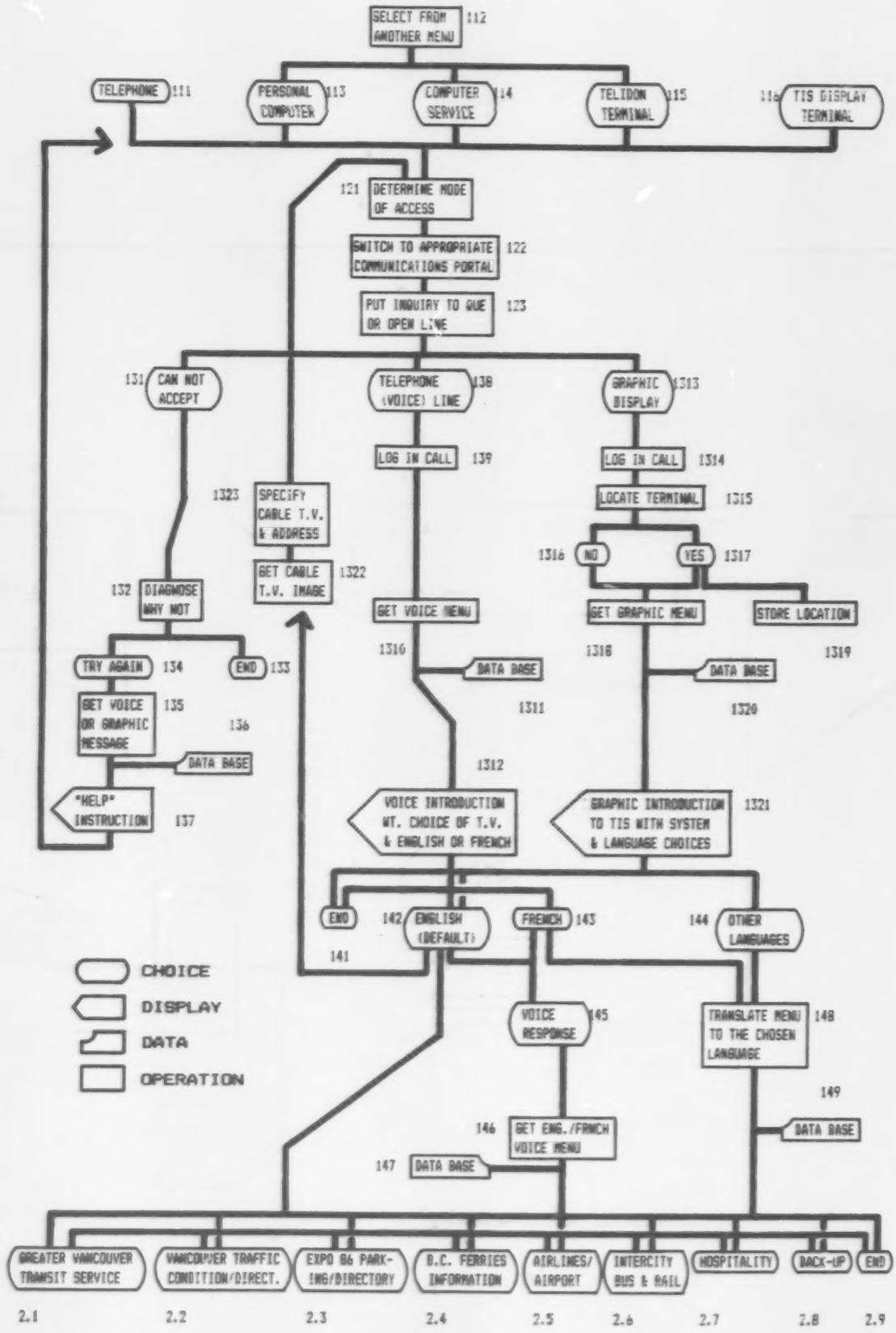


FIGURE A-2

PUBLIC TRANSIT LOGIC (GRAPHIC)

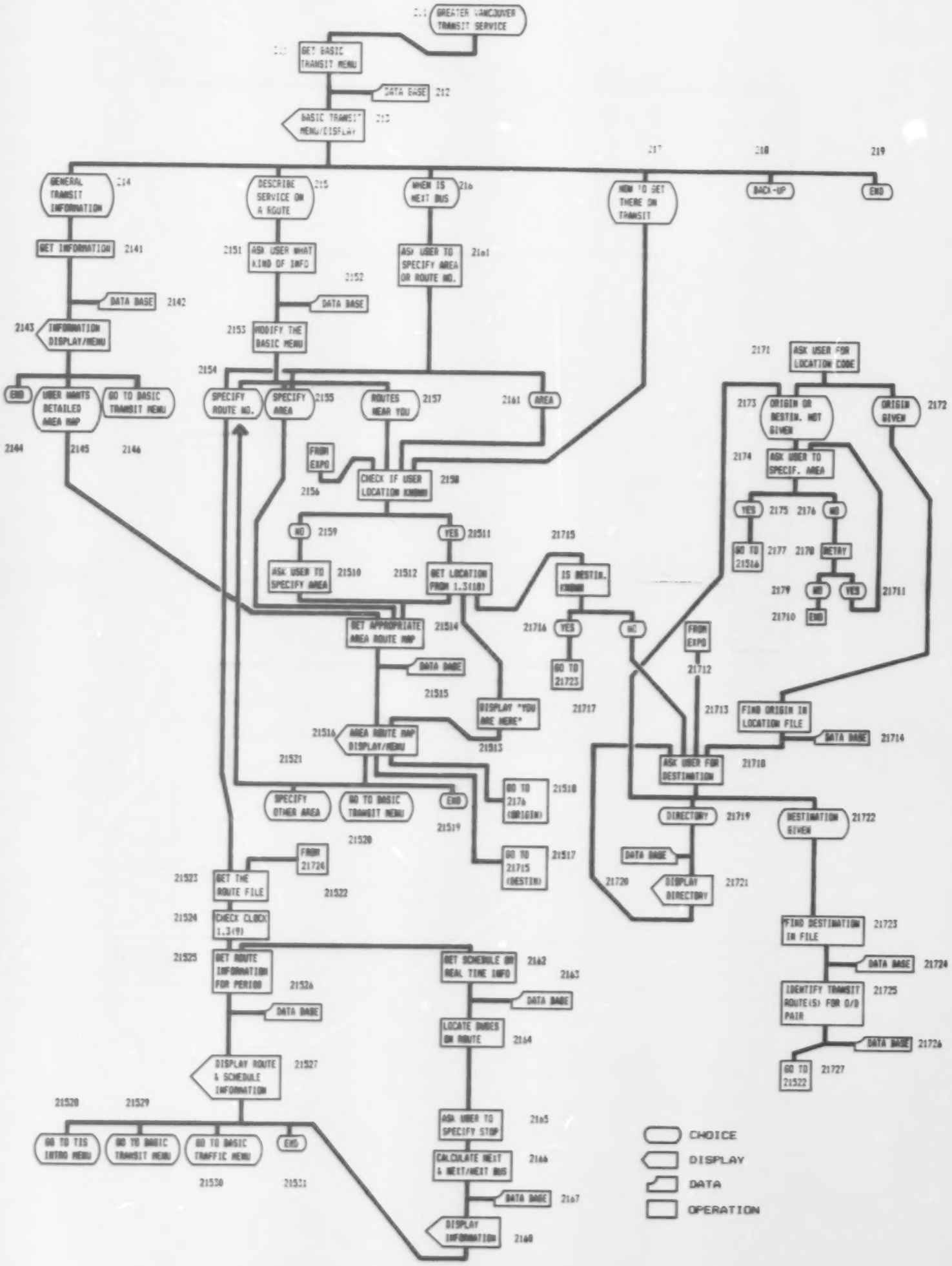


Figure A-3

TRAFFIC CONDITIONS LOGIC (GRAPHIC)

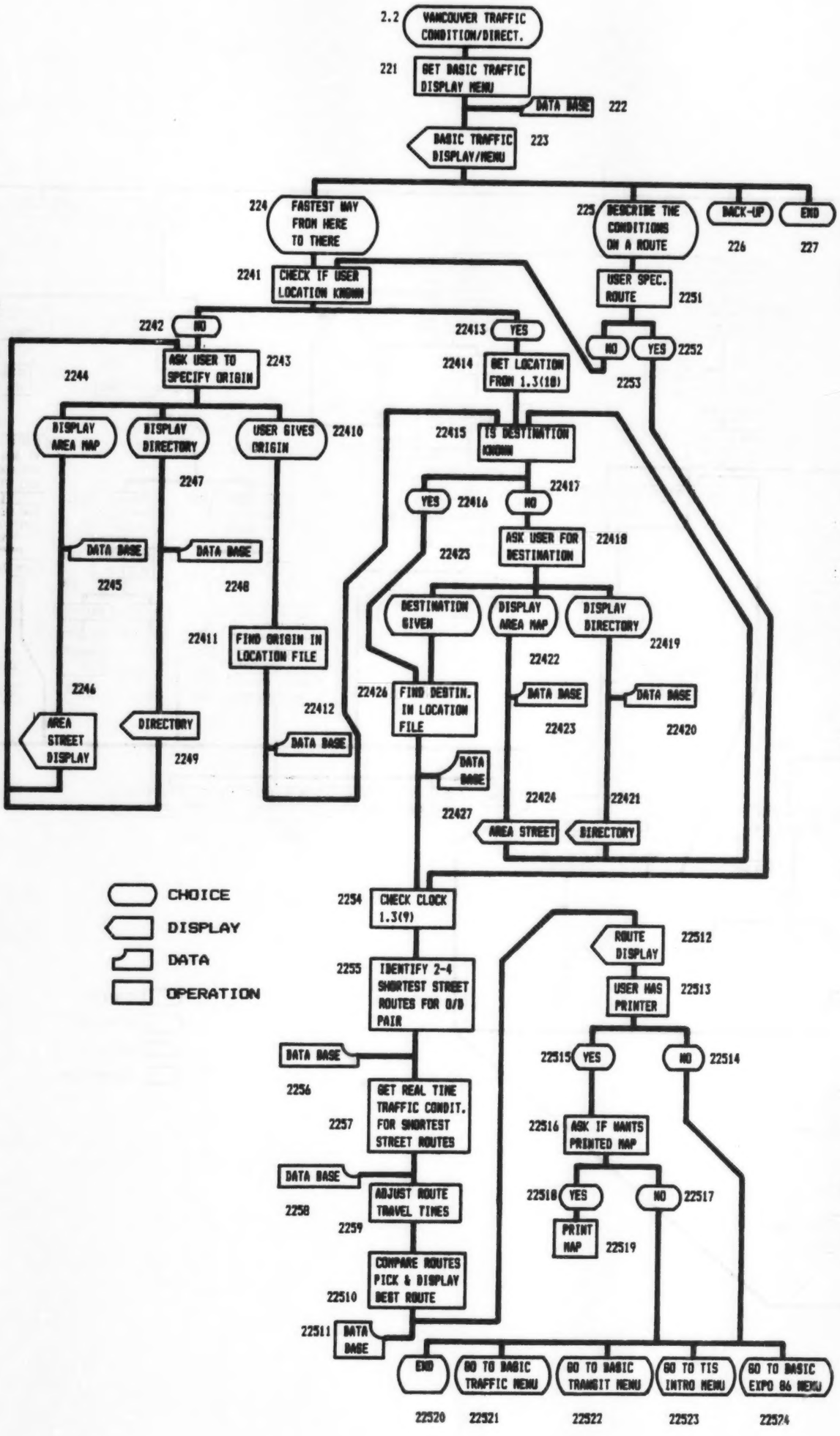


Figure A-4

EXPO 86 PARKING/DIRECTORY LOGIC (GRAPHIC)

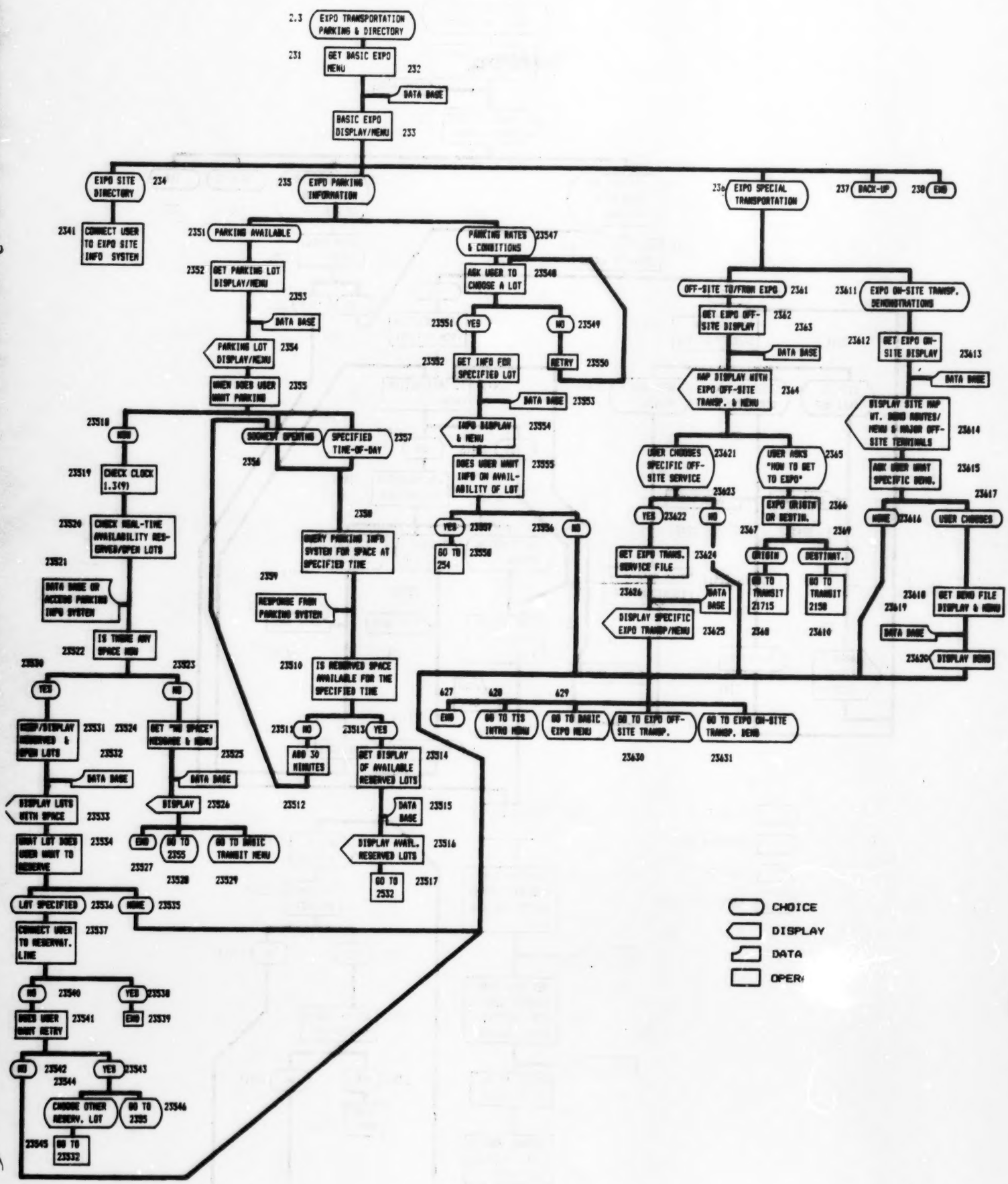


Figure A-5

B.C. FERRIES INFORMATION LOGIC (GRAPHIC)

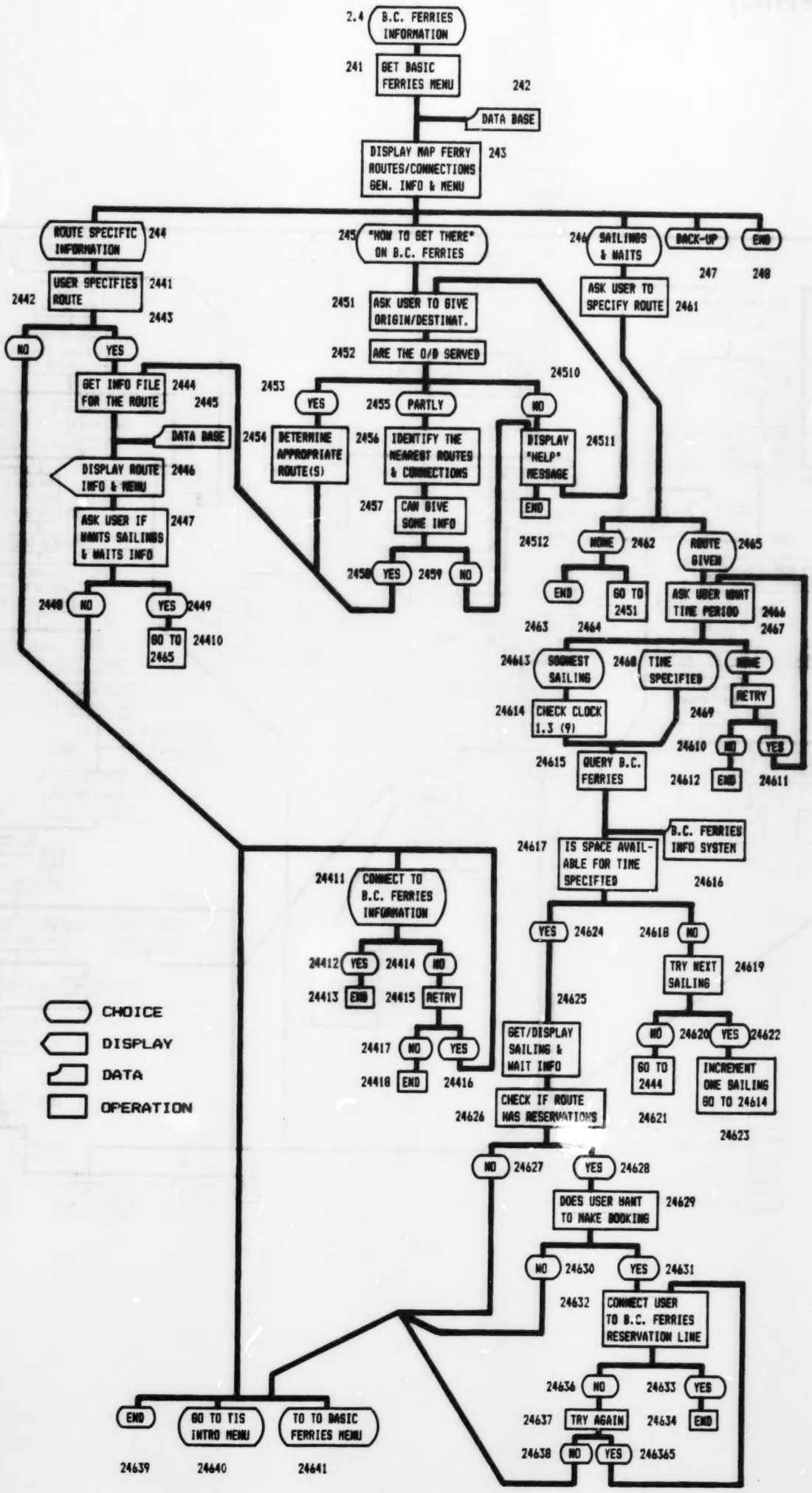


Figure A-6

AIRLINES/AIRPORT INFORMATION LOGIC (GRAPHIC)

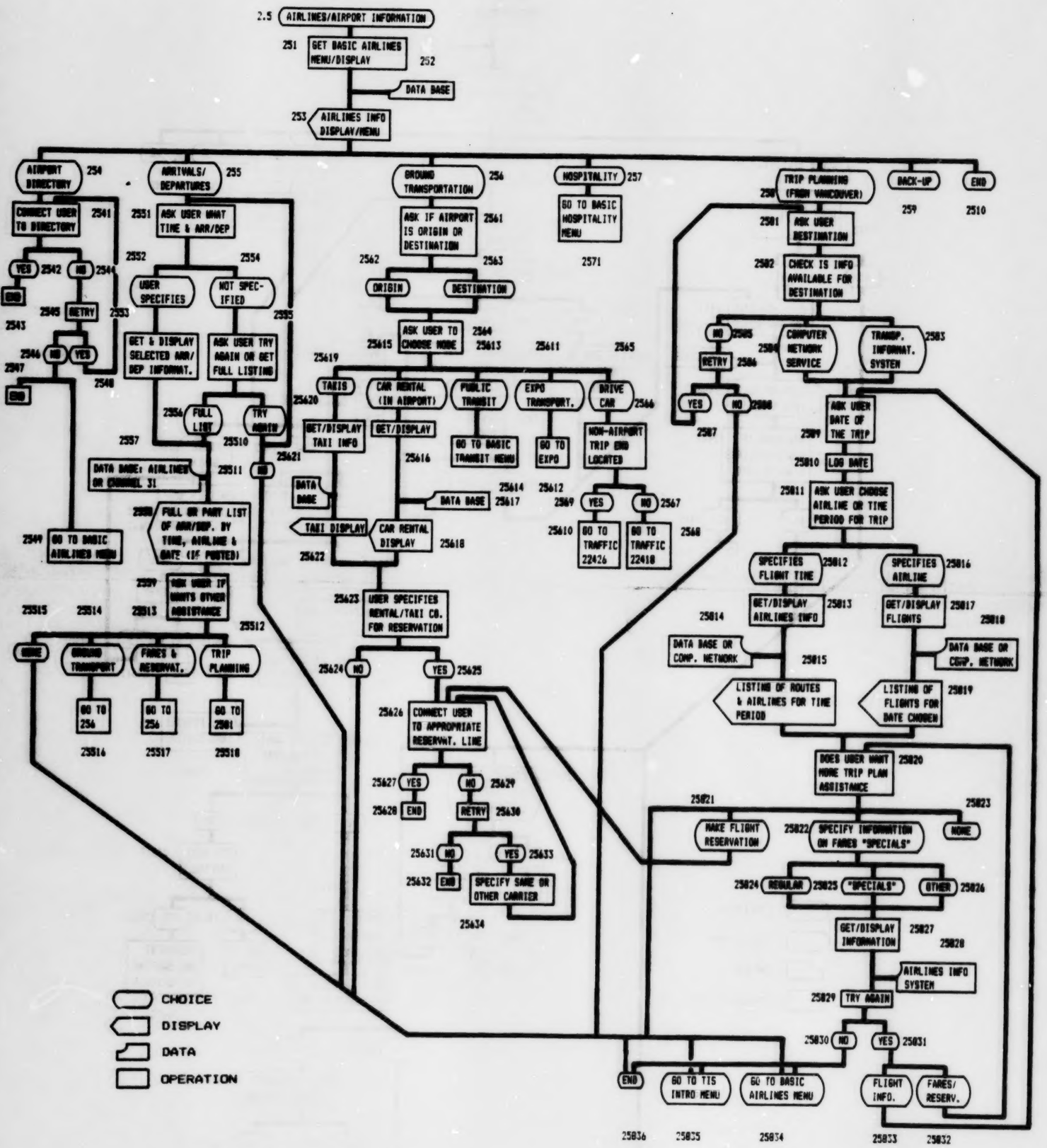


Figure A-7

INTERCITY BUS/RAIL INFORMATION LOGIC (GRAPHIC)

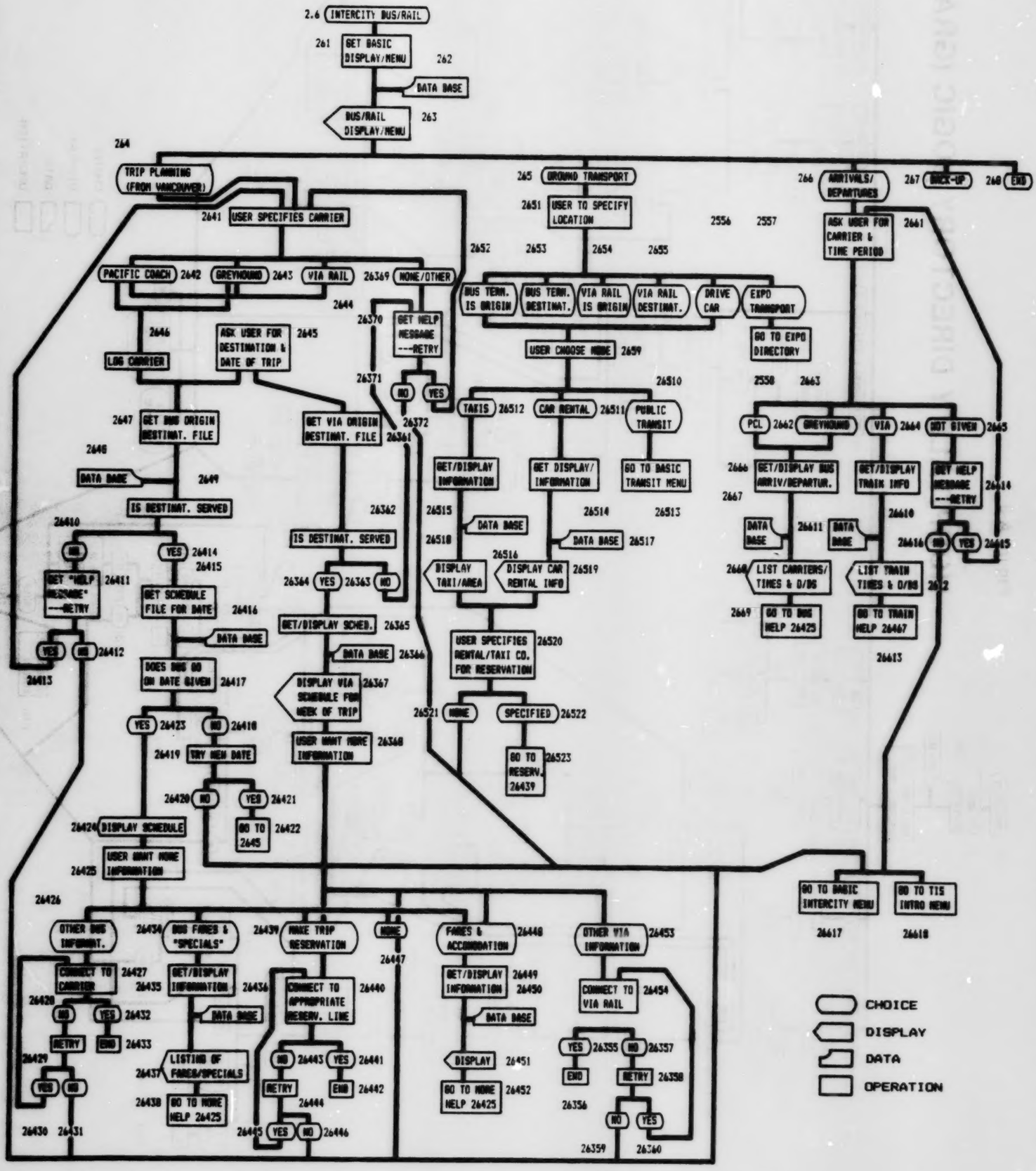
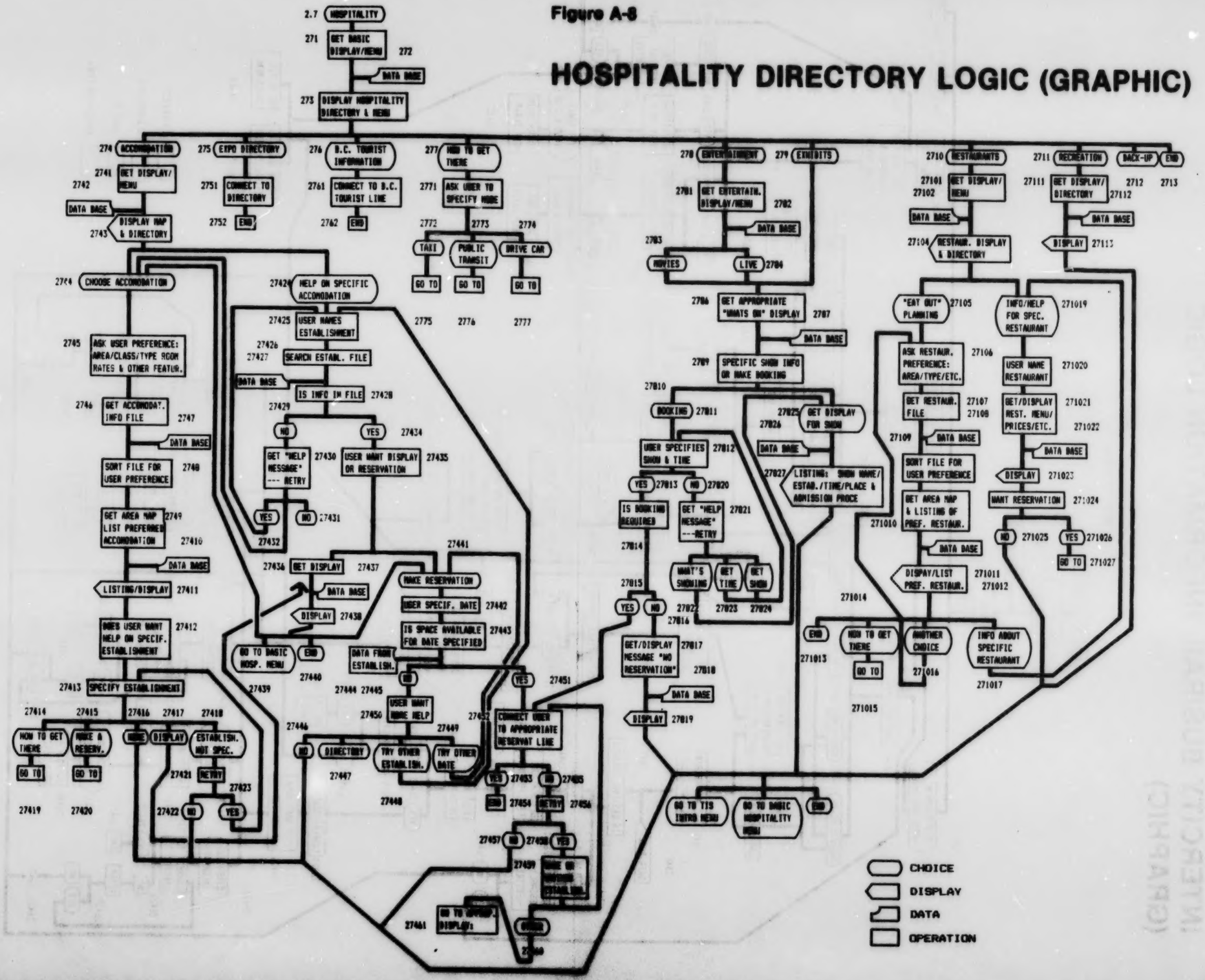


Figure A-8

HOSPITALITY DIRECTORY LOGIC (GRAPHIC)



APPENDIX B

DATA BASE

Figure B-1

DATA BASE AND RESPONSE STRUCTURE

1. THE USER INTERFACE(TERMINAL OR PHONE)

2. POINTERS SET BY INTERFACE AND INTERACTION

3. THE TRANSPORTATION INFORMATION DATA BASE

2. pointers set by interface and interaction

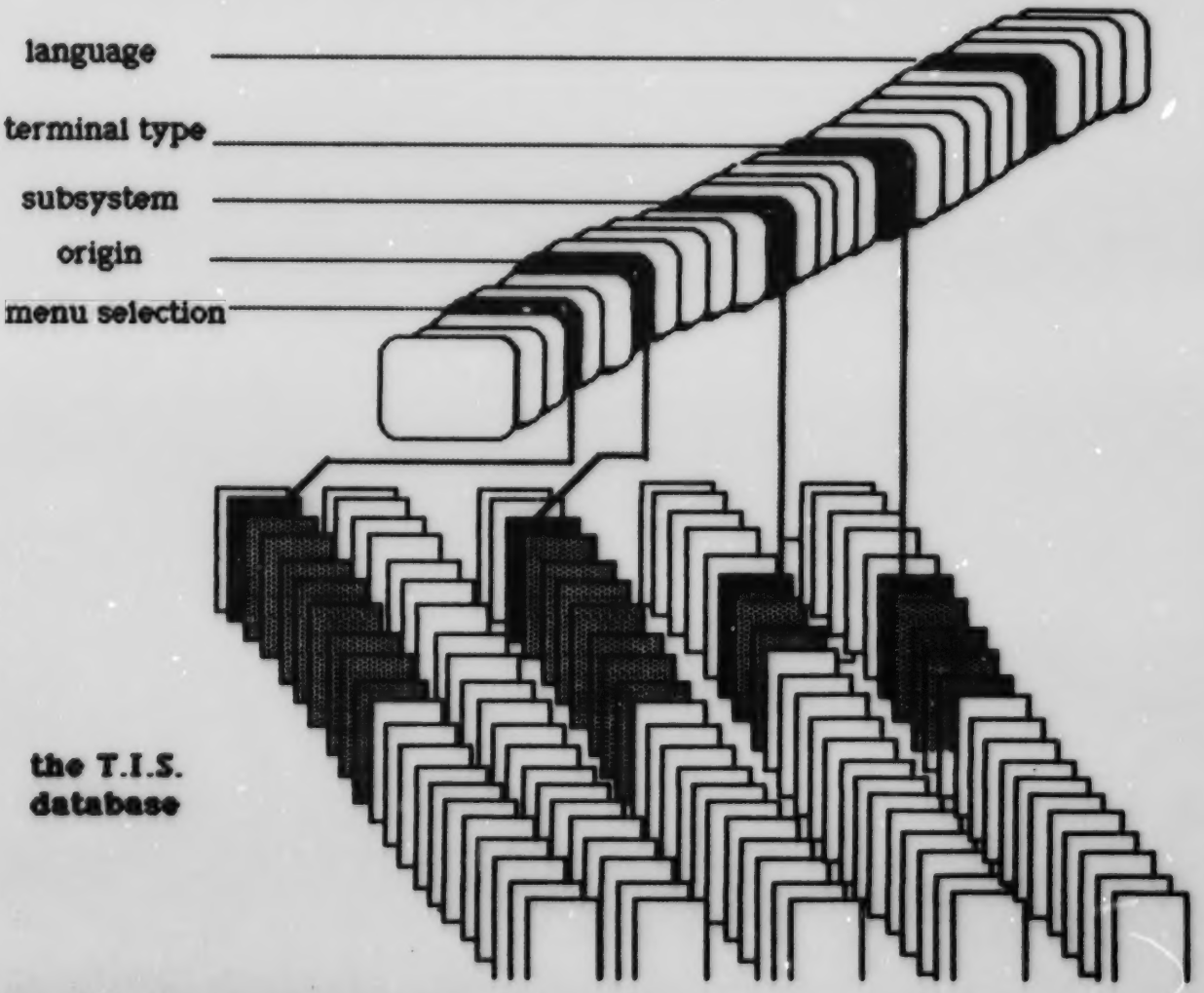


Figure B-2

DATA BASE OUTLINE

CATEGORY	INQUIRY	DATA	PRIMARY SOURCE
1. Public Transit			
	GENERAL INFORMATION	1.1 General maps of areas in Lower Mainland:	Regional District
		1.2 Transit route maps for each area:	Metro Transit
		1.3 Description of Fares, Hours of Service and other characteristics:	Metro Transit
	WHAT BUS TO TAKE	1.4 Trip origin and destination zones developed for EMME-II small area analysis:	Regional District
		1.5 Transit route networks developed for EMME-II:	Regional District
		1.6 Stop locations and transfer points:	Metro Transit
	SCHEDULED NEXT BUS	1.7 Trip origin/destination and route:	(See 1.4-6)
		1.8 Scheduled arrival times at major timing points by route from master schedule:	Metro Transit
		1.9 Shortest path assignment for trip from EMME-II:	Regional District
		1.10 Adjusted arrival based on traffic conditions:	(See 2.)
	SERVICE ON A SPECIFIC ROUTE	1.11 Transit route networks (per 1.5 above), plus a narrative description of headways, main connecting routes and other information:	Metro Transit
2. Vancouver Traffic Conditions			
	WHAT ROUTE TO TAKE	2.1 General maps of areas:	(See 1.1)
		2.2 Major roadway networks and trip origin/destinations:	(See 1.4-5)
		2.3 Stored shortest path assignment on major routes:	Regional District
	TRAFFIC CONDITIONS ON A ROUTE	2.4 Shortest paths:	(See 1.4-5,2.3)
		2.5 Adjusted travel times by route from traffic density and speed data supplied by traffic management system induction loops:	City of Vancouver Dept. of Highways
3. EXPO 86 Parking and Directory			
	WHAT PARKING IS AVAILABLE	3.1 General survey of parking in Downtown area:	City of Vancouver
		3.2 Periodic status reports:	Parking Operators
		3.3 Monitoring of parking reservation system:	Not Yet Set Up
	EXPO TRANSPORTATION	3.4 General description of transportation services:	EXPO 86
		3.5 Reservations and real-time information:	Portal to EXPO
		3.6 Transportation to EXPO:	EXPO & flag other ITIS info.

4. B.C. Ferries Information

GENERAL INFORMATION	4.1 B.C. map of ferry routes and destinations	B.C. Ferries
	4.2 Description of Fares, Hours of Service and other characteristics:	B.C. Ferries
WHAT FERRY TO TAKE	4.3 Origin and destination locations catelogued by route and a simplified network derived from Ferries schedules and provincial highways:	B.C. Ferries & Dept. of Highways
SAILINGS, LINE-UPS AND WAITS	4.4 Current information by route and route specific reservation status from access to Ferries operations and information systems:	B.C. Ferries

5. Airlines and Airport Information

ARRIVALS/DEPARTURES	5.1 Access Vancouver Airport monitoring system:	Airlines or Cable Company
TRIP PLANNING	5.2 Access existing computer service networks on a selective basis to provide Vancouver to elsewhere information:	Commercial Data Bases
GROUND TRANSPORTATION	5.3 General transportation information:	(See 1 & 2 above)
	5.4 Limo routes and destinations:	Operators
	5.5 Taxi service areas, fares to popular destinations and other service characteristics:	Operators

6. Intercity Bus and Rail

ARRIVALS/DEPARTURES	6.1 Scheduled arrivals/departures for buses, with notification of any actual changes. Rail arrivals/departures by periodic notification:	Operators
GENERAL INFORMATION	6.2 Description of Fares, destinations and other info:	Operators
GROUND TRANSPORTATION	(See 5.3-5)	

APPENDIX C

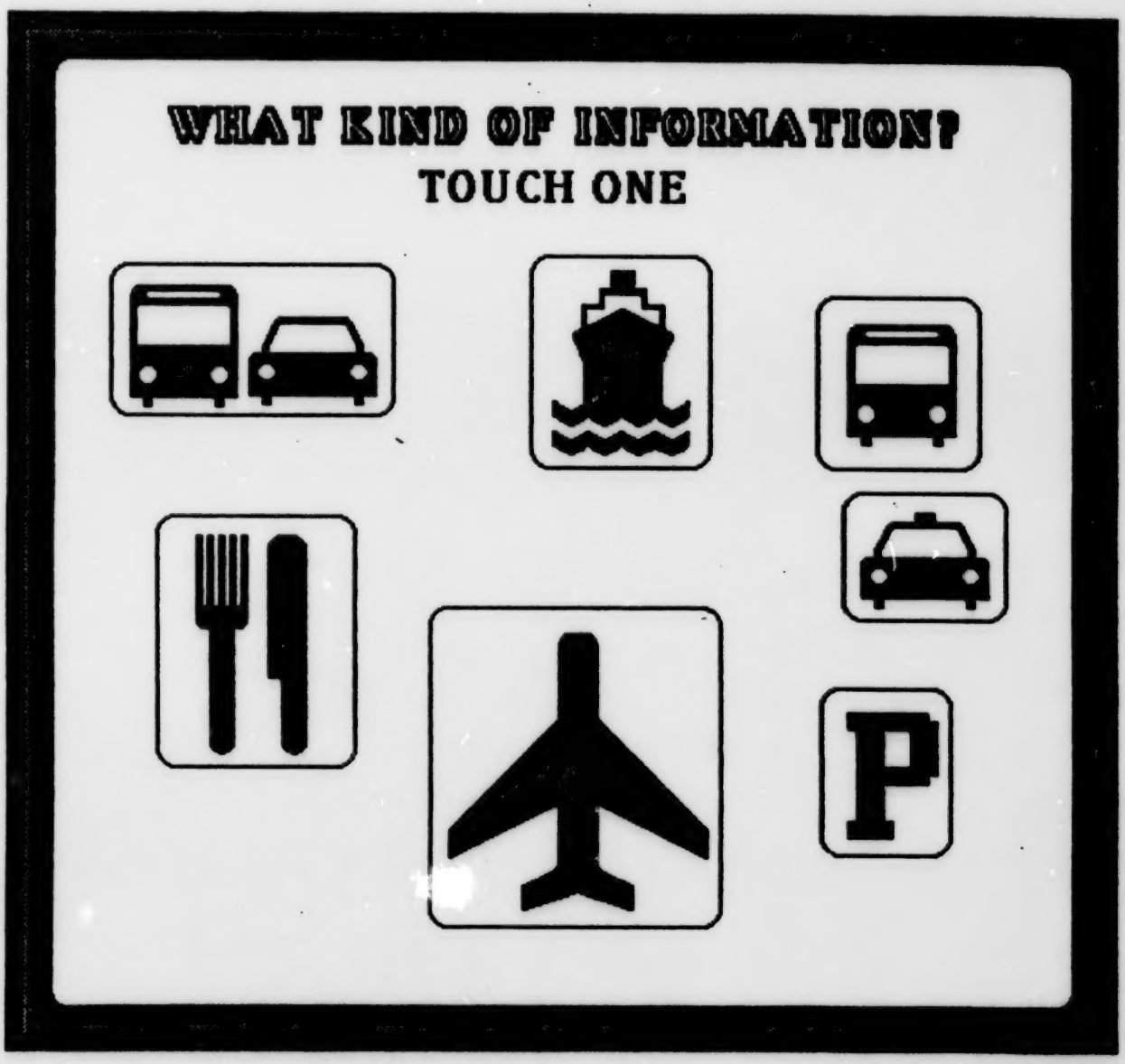
Figure C-1

GRAPHIC DISPLAYS FOR TIS DIALOGUE

THE INITIAL DISPLAY

Figure C-2

GRAPHIC DISPLAYS FOR TIS DIALOGUE



THE EXACT INSTRUCTIONS AND LANGUAGE WILL VARY ACCORDING TO THE CIRCUMSTANCES

Figure C-3

GRAPHIC DISPLAYS FOR TIS DIALOGUE